MPXPRO

CAREL

GB User manual

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Technology & Evolution

User manual

IMPORTANT WARNINGS

CAREL bases the development of its products on decades of experience in HVAC, on the continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. CAREL and its subsidiaries nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques. The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, acts as a consultant for the positive commissioning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system.
The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.carel.com.
Each CAREL product, in relation to its advanced level of technology, requires setup/configuration/programming/commissioning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL accepts no liability in such cases.
Only qualified personnel may install or carry out technical service on the product.
The customer must only use the product in the manner described in the documentation relating to the product.
In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:

- Prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corrosive minerals that may damage the electronic circuits. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual;
- Do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual;
- Do not attempt to open the device in any way other than described in the manual;
- Do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged;
- Do not use corrosive chemicals, solvents or aggressive detergents to clean the device;
- Do not use the product for applications other than those specified in the technical manual.

All of the above suggestions likewise apply to the controllers, serial boards, programming keys or any other accessory in the CAREL product portfolio.

CAREL adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning.

The technical specifications shown in the manual may be changed without prior warning.

The liability of CAREL in relation to its products is specified in the CAREL general contract conditions, available on the website www.carel.com and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL, its employees or subsidiaries be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or impossibility to use the product, even if CAREL or its subsidiaries are warned of the possibility of such damage.

Disposal of the product: the product is made up of metal parts and plastic parts.
In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. The public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment.
3. The equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. The symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

If the appliance is used in a way that is not described by the manufacturer, the specified level of protection may be affected.

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ENGLISH

1. INTRODUCTION

1.1 MPXPRO

MPXPRO is the CAREL product for the complete and advanced management of stand-alone or multiplexed refrigeration units. **MPX**PRO includes a wide range of integrated microprocessor parametric controllers, optional electronic boards, terminals, displays and accessories that ensure high flexibility and extended functions for the management of showcases or cold rooms.
MPXPRO can independently manage the control and operation of a refrigeration unit, implement a vats series of functions and emergency procedures to avoid critical situations, control stepper or PWM electronic expansion valves, synchronise a master-slave network with a maximum of 5 units, and connect to the supervisor network for complete monitoring of the installation.
MPXPRO is only available in the "split" version for DIN rail assembly, with the user terminal separate from the power unit. It can be configured using a remote terminal, remote control, supervisor and commissioning software on a PC directly connected to the user terminal.

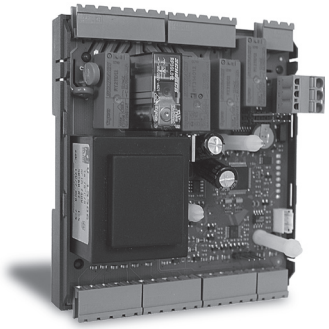


Fig. 1.a

1.2 Components

The series of **MPX**PRO controllers is made up of:

MPXPRO master (MX20M***) (Fig. 1.a)**
Device that can independently control a refrigeration unit using a wide range of probes, digital or analogue inputs and outputs specially designed and sized for the specific functions. In addition, it is fitted with a clock (RTC) for the synchronisation of the events in the tLAN and features connection to the supervisor network (RS485).

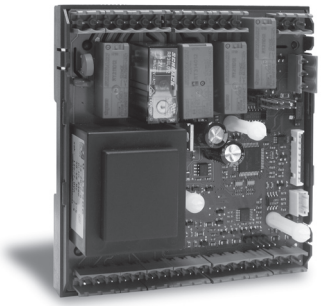


Fig. 1.b

MPXPRO slave (MX20S***) (Fig. 1.b)**
Device similar to the master version, without the serial board (RS485) and Real Time Clock (RTC). These functions are carried out by the master unit connected in the LAN, or alternatively can be included by installing the optional clock board and RS485 interface (MX2OP48500).

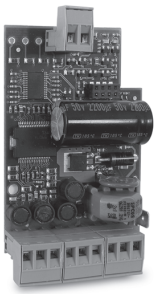


Fig. 1.c

Stepper EEV expansion board (MX2OPSTP) (Fig. 1.c)**
Optional board for controlling a CAREL E2V electronic expansion valve driven by stepper motor. Model MX2OPSTP0* also has a 0 to 10 V modulating output for the control of external actuators.
It is installed on the main board using special fastening holes.

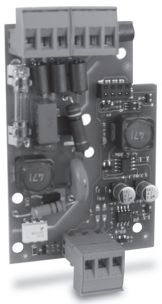


Fig. 1.d

PWM EEV expansion board (Pulse-Width Modulation (MX2OPPWM) (Fig. 1.d)**
Optional board for controlling an AC or DC PWM electronic expansion valve live. Model MX2OPPWM0* also has a 0 to 10 V modulating output for the control of external actuators.
It is installed on the main board using special fastening holes.

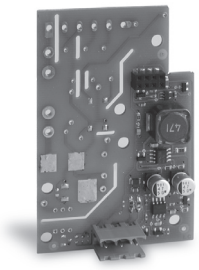


Fig. 1.e

0 to 10 Vdc expansion board (MX2OPA100*) (Fig. 1.e)
Optional board used to control external actuators with 0 to 10 Vdc modulating output.
It is installed on the main board using special fastening holes.

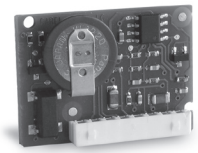


Fig. 1.f

RTC board and RS485 interface (MX2OP48500) (Fig. 1.f)
Optional board used to add the RTC and RS485 interface functions in the MPXPRO Slave models. The master versions are already fitted with this board.

Fig. 1.g

USB/I2C converter (IROPZPRG00) for programming key (Fig. 1.g)
Converter used to interface a PC (running special software) with a standard CAREL programming key IROPZKEY00/A0 (see Chapter 7).

Fig. 1.h

USB/tLAN converter for commissioning tool (IROPZTLN00) (Fig. 1.h)
Converter used to interface a PC (running special "commissioning" software) with an MPXPRO device.

Fig. 1.i

Small display terminal (IRU*****)(Fig. 1.i)**
Remote user terminal with 3 digits and 4 buttons for displaying the status and setting the device parameters.

Fig. 1.j

Small display (IRX*****) (Fig. 1.j)**
User display used to display the status of a variable directly set on the instrument.

For further information on electrical connections, see p. 12

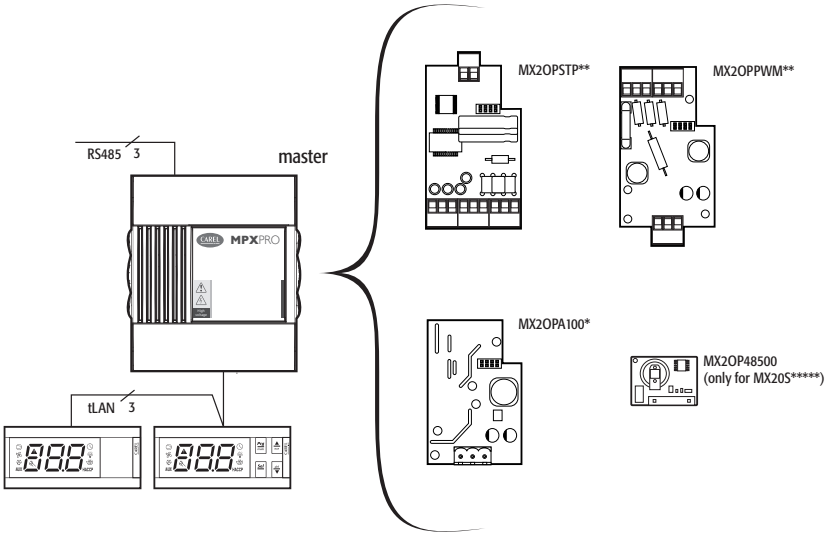
1.3 Functional diagrams

The **MPX**PRO controllers are systems that manage refrigeration units (for example, one or a series of multiplexed showcases). These systems are made up of control boards connected together in master-slave mode; each master board can manage up to 4 slave boards.
The functional diagrams below show some examples of typical applications.

"Stand alone" diagram and applicable options

Fig. 1.k

Available options:
• expansion board for the management of CAREL E2V Stepper valves (MX2OPSTP**);



• expansion board for the management of PWM valves (Pulse-Width Modulation) (MX2OPPWM**);
• 0-10 Vdc expansion board (MX2OPA100*)

In addition, the **MPX**PRO slave (MX20S*****) slave boards (MX20S*****) can be fitted with the RTC and RS485 serial interface (MX2OP48500)

Master - slave network with terminals and displays

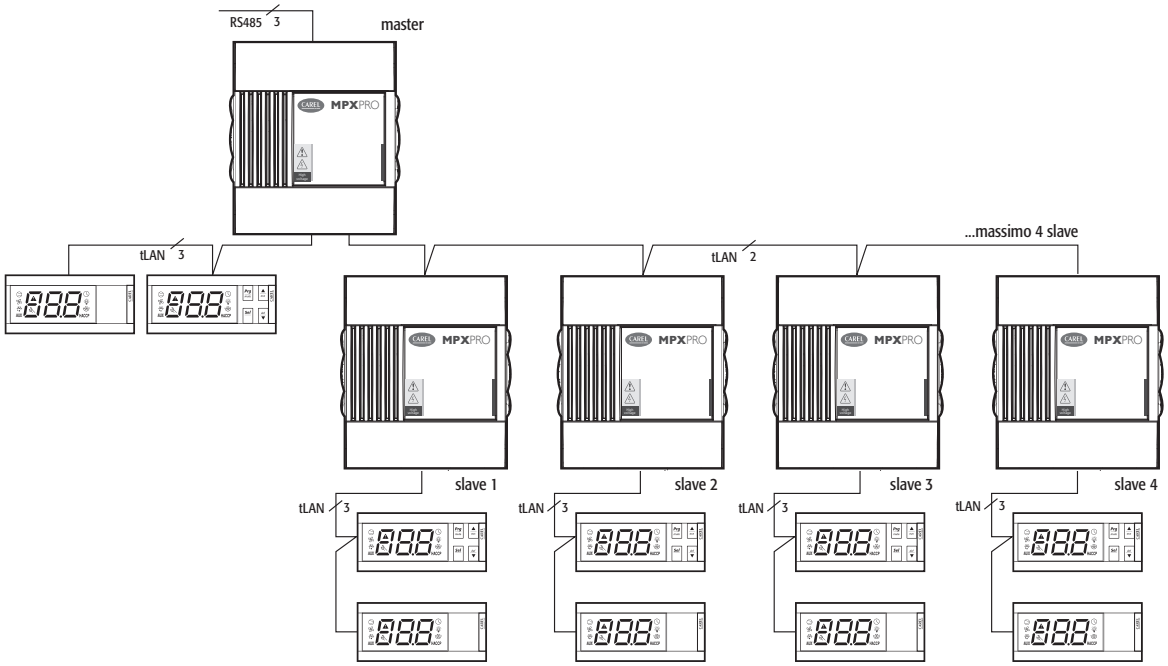


Fig. 1.l

The master unit, connected to the supervisor network, acts as the gateway and coordinates the functions of the 4 slave units connected in the LAN.
Each device has its own user terminal and display.

Master - slave network with terminals and displays shared by the master

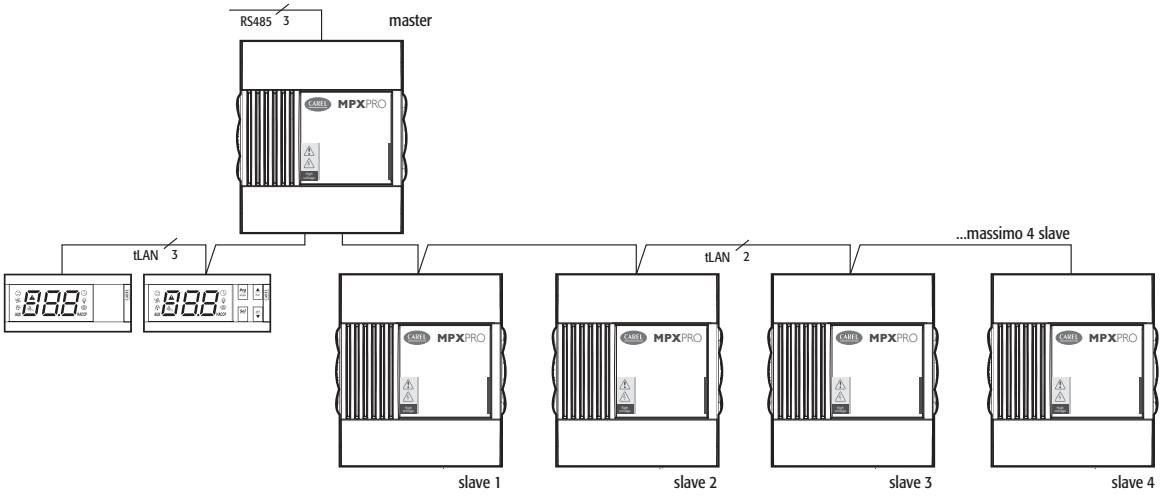


Fig. 1.m

The master unit, connected to the supervisor network, acts as the gateway and coordinates the functions of the 4 slave units connected in the LAN.
The user terminal connected to the master unit can be used to navigate inside the local network and modify and/or display the settings and variables of all the slave units connected.

RS485 supervisor network

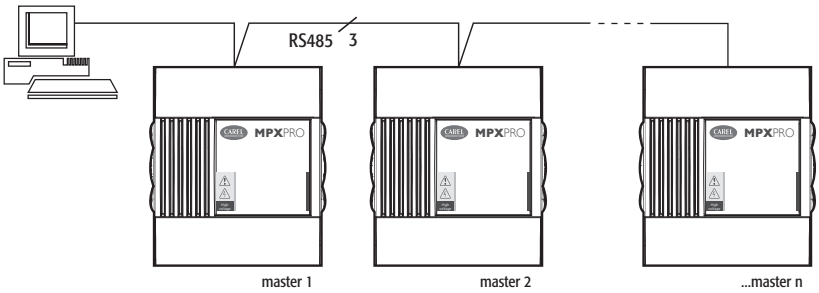


Fig. 1.n

Connection of the master unit to the RS485 serial supervisor network. Each master unit can act as a gateway to the supervisor for any 4 slave units connected.

1.4 Models

The controllers, options and accessories of the **MPX**PRO series are available in the following versions:

Basic models

Code	Master/ Slave	RS485 & RTC	Relay	Pt1000	E²V Driver	PWM Driver	0-10 Vdc output	PWM outputs
MX20M00EO0	Master	Y	5R (8-2HP-16-8-8)	-	-	-	-	-
MX20S00EO0	Slave	N	5R (8-2HP-16-8-8)	-	-	-	-	-
MX20S10EO0	Slave	N	3R (8-0-16-0-8)	-	-	-	-	-

(Y:present, N: optional, -: Not available)

Tab. 1.a

Full optional models

Code	Master/ Slave	RS485 & RTC	Relay	Pt1000	E²V Driver	PWM Driver	0-10 Vdc output	PWM outputs
MX20M21EO0	Master	Y	5R (8-2HP-16-8-8)	Y	-	-	-	2
MX20S21EO0	Slave	N	5R (8-2HP-16-8-8)	Y	-	-	-	2
MX20S31EO0	Slave	N	3R (8-0-16-0-8)	Y	-	-	-	2

(Y:present, N: optional, -: Not available)

Tab. 1.b

Boards with E2V driver option pre-installed

Code	Master/ Slave	RS485 & RTC	Relay	Pt1000	E²V Driver	PWM Driver	0-10 Vdc output	PWM outputs
MX20M25EO0	Master	Y	5R (8-2HP-16-8-8)	Y	Y	-	Y	2
MX20S25EO0	Slave	N	5R (8-2HP-16-8-8)	Y	Y	-	Y	2
MX20M24EO0	Master	Y	5R (8-2HP-16-8-8)	Y	-	Y	Y	2
MX20S24EO0	Slave	N	5R (8-2HP-16-8-8)	Y	-	Y	Y	2

(Y:present, N: optional, -: Not available)

Tab. 1.c

Options and accessories

Code	Description
IR00UGC200	Terminal (green LED, full optional, IR, commissioning)
IR00XGC200	Display (green LED, full optional, IR, commissioning)
IR00UG6200	Terminal (green LED, no options, without IR, without commissioning)
IR00XG6200	Display (green LED, no options, without IR, without commissioning)
MX2OP48500	**MPXPRO OPTION, RS485 + RTC MODULE**
TRADRBE240	Transformer for DIN 230Vac/24Vac 20VA with fuse carrier
TRA00BE240	Transformer for PANEL 230Vac/24Vac 20VA with fuse carrier
IROPZTLN00	Commissioning interface (USB-tLAN)
IROPZPRG00	Programming key interface (USB-I2C)

Tab. 1.d

2. MECHANICAL AND ELECTRICAL INSTALLATION

The following paragraphs illustrate the assembly procedures and the electrical connections for the **MPX-**PRO board and the MX2OPSTP*, MX2OPPWM*, MX2OPA100* expansion boards*

2.1 Removing the top and side covers

Important: The assembly operations must be performed with the board disconnected from the power supply

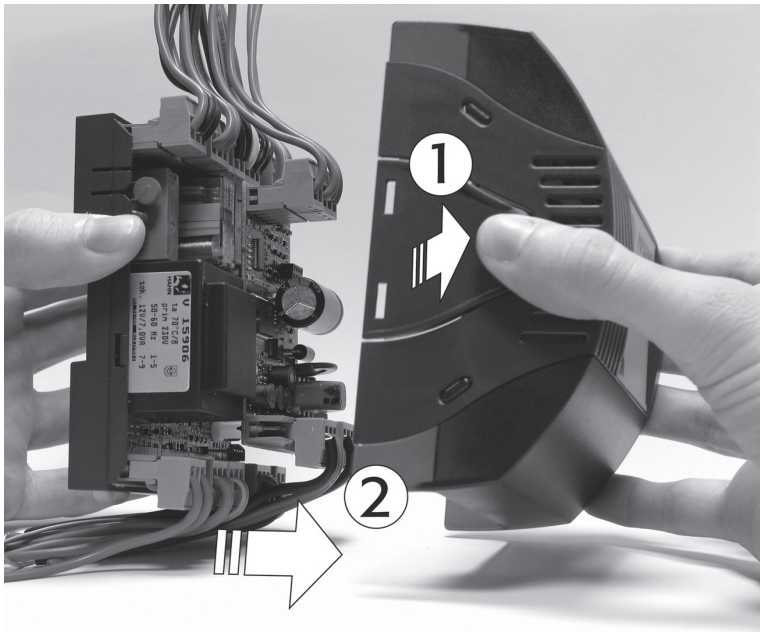


Fig. 2.a

Fig. 2.a: removing the top cover

① press sideways

② remove the cover

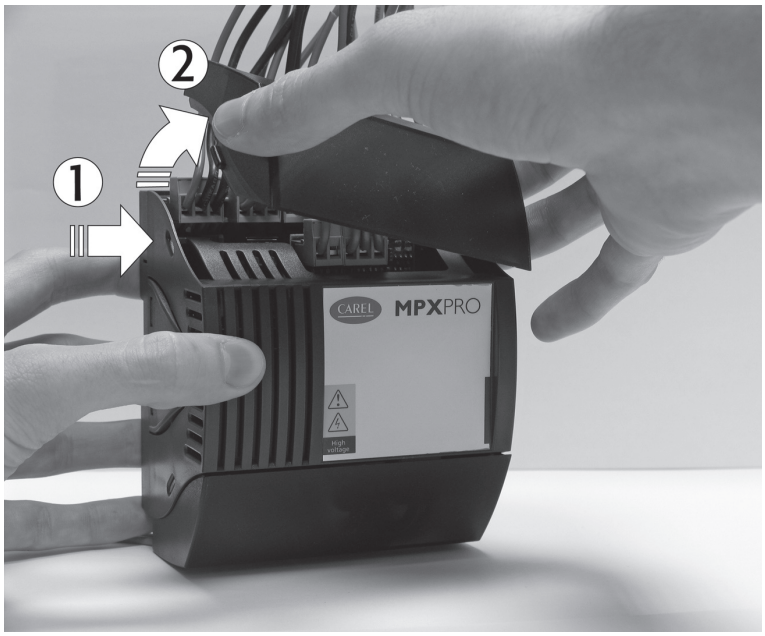


Fig. 2.b

Fig. 2.b: removing the side cover

① press the cover sideways at the hinges

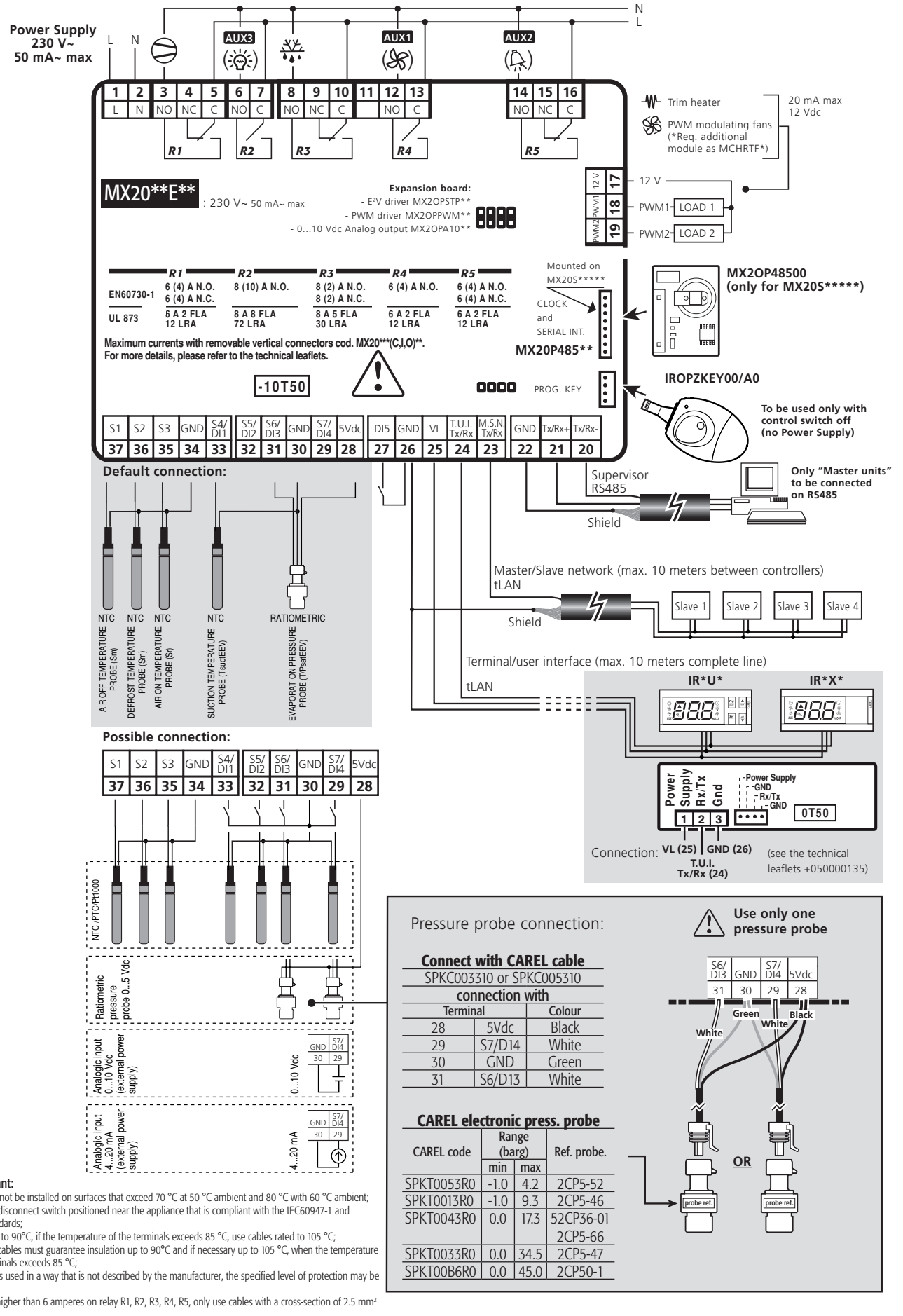
② remove the cover

ENGLISH

2.2 MX20* board wiring diagram and connections

The diagram refers to a full optional board (maximum inputs and outputs).
To check which inputs and outputs are effectively present on the model in question, see par. 1.4 Models

Important: The connections must be performed with the board disconnected from the power supply.


Power Supply
230 V~
50 mA~ max
L
N
AUX3
AUX1
AUX2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
L N NO NC C NO C NO NC C NO C NO NC C
R1 R2 R3 R4 R5
MX20**E**
: 230 V~ 50 mA~ max
Expansion board:
- E²V driver MX2OPSTP**
- PWM driver MX2OPPWM**
- 0...10 Vdc Analog output MX2OPA10**
Trim heater
PWM modulating fans
(*Req. additional module as MCHRTF*)
20 mA max
12 Vdc
12 V
PWM1
PWM2
LOAD 1
LOAD 2
EN60730-1
UL 873
R1 6 (4) A N.O. 6 (4) A N.C. 6 A 2 FLA 12 LRA
R2 8 (10) A N.O. 8 A 8 FLA 72 LRA
R3 8 (2) A N.O. 8 (2) A N.C. 8 A 5 FLA 30 LRA
R4 6 (4) A N.O. 6 A 2 FLA 12 LRA
R5 6 (4) A N.O. 6 (4) A N.C. 6 A 2 FLA 12 LRA
Maximum currents with removable vertical connectors cod. MX20***(C,I,O)**.
For more details, please refer to the technical leaflets.
-10T50
Mounted on MX20S*****
CLOCK and SERIAL INT.
MX20P485**
PROG. KEY
MX2OP48500 (only for MX20S*****)
IROPZKEY00/A0
To be used only with control switch off (no Power Supply)
S1 S2 S3 GND S4/DI1 S5/DI2 S6/DI3 GND S7/DI4 5Vdc DI5 GND VL T.U.I. Tx/Rx M.S.N. Tx/Rx GND Tx/Rx+ Tx/Rx-
37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20
Default connection:
NTC NTC NTC NTC RATIOMETRIC
AIR OFF TEMPERATURE PROBE (Sm)
DEFROST TEMPERATURE PROBE (Sm)
AIR ON TEMPERATURE PROBE (Si)
SUCTION TEMPERATURE PROBE (TsuctEEV)
EVAPORATION PRESSURE PROBE (T/PsatEEV)
Supervisor RS485
Shield
Only "Master units" to be connected on RS485
Master/Slave network (max. 10 meters between controllers)
tLAN
Shield
Slave 1
Slave 2
Slave 3
Slave 4
Terminal/user interface (max. 10 meters complete line)
tLAN
IR*U*
IR*X*
Power Supply
Rx/Tx
Gnd
-Power Supply
-GND
-Rx/Tx
-GND
1 2 3
0T50
Connection: VL (25) GND (26) T.U.I. Tx/Rx (24)
(see the technical leaflets +050000135)
Possible connection:
S1 S2 S3 GND S4/DI1 S5/DI2 S6/DI3 GND S7/DI4 5Vdc
37 36 35 34 33 32 31 30 29 28
NTC /PTC/Pt1000
Ratiometric pressure probe 0...5 Vdc
Analogic input 0...10 Vdc (external power supply)
0...10 Vdc
GND S7/DI4
30 29
Analogic input 4...20 mA (external power supply)
4...20 mA
Pressure probe connection:
Use only one pressure probe
S6/DI3 GND S7/DI4 5Vdc
31 30 29 28
Green
Black
White
White
OR
probe ref.
probe ref.

Connect with CAREL cable
SPKC003310 or SPKC005310
connection with

Terminal		Colour
28	5Vdc	Black
29	S7/D14	White
30	GND	Green
31	S6/D13	White

CAREL electronic press. probe

CAREL code	Range (barg) min	Range (barg) max	Ref. probe.
SPKT0053R0	-1.0	4.2	2CP5-52
SPKT0013R0	-1.0	9.3	2CP5-46
SPKT0043R0	0.0	17.3	52CP36-01 2CP5-66
SPKT0033R0	0.0	34.5	2CP5-47
SPKT00B6R0	0.0	45.0	2CP50-1

Important:
- The board must not be installed on surfaces that exceed 70 °C at 50 °C ambient and 80 °C with 60 °C ambient;
- Use an external disconnect switch positioned near the appliance that is compliant with the IEC60947-1 and IEC60947-3 standards;
- Use cables rated to 90°C, if the temperature of the terminals exceeds 85 °C, use cables rated to 105 °C;
- The connection cables must guarantee insulation up to 90°C and if necessary up to 105 °C, when the temperature of the relay terminals exceeds 85 °C;
- If the appliance is used in a way that is not described by the manufacturer, the specified level of protection may be affected;
- If the current is higher than 6 amperes on relay R1, R2, R3, R4, R5, only use cables with a cross-section of 2.5 mm² (14 AVG);
- The board must not be accessible to unauthorised persons.

Fig. 2.c

Power supply and digital outputs

Terminal		Function	Type of relay
1	L	Power supply	230 Vac 50 mA max. Mx20*A*: 115 Vac 100 mA max
2	N		
3	NO	Relay 1	EN60730-1: 6(4)A
4	NC		UL 873: 8 A 2 FLA 12 LRA
5	C		
6	NO	Relay 2	EN60730-1: 8(10) A
7	C		UL 873: 12A 12 FLA 72 LRA
8	NO	Relay 3	EN60730-1: 8(2) A
9	NC		UL 873: 12 A 5 FLA 30 LRA
10	C		
11	-	Not used	-
12	NO	Relay 4	EN60730-1: 6(4) A
13	C		UL 873: 8 A 2 FLA 12 LRA
14	NO	Relay 5	EN60730-1: 6(4) A
15	NC		UL 873: 8 A 2 FLA 12 LRA
16	C		

Tab. 2.a

Open collector/PWM analogue output connections

Terminal		Function
17	+12 V	Power supply
18	PWM1	Open collector PWM1 20 mA max 12 Vdc
19	PWM2	Open collector PWM2 20 mA max 12 Vdc

Tab. 2.b

Depending on the model, the main board may have two open collector PWM analogue outputs for connecting:
- SSR relay for the anti-sweat heaters on the display cabinets (hot wire);
- Phase cutting controllers for inductive loads (e.g. fans with inductive motors for opto-isolated control);
- Phase cutting controllers for capacitive loads (e.g. fans with BRUSHLESS motors for opto-isolated control).

LAN connections

Terminal		Function	Type of network
20	TX/RX-	Supervisor network connection (shielded cable).	RS485
21	TX/RX+		
22	GND		
23	M.S.N. TX/RX	Connection to master-slave LANM.S.N. Master/Slave network (shielded cable).	tLAN network
26	GND		
24	T.U.I TX/RX	Connections on the MPXPRO display and terminals.T.U.I. (terminal/user interface)	tLAN terminals and display
25	VL		
26	GND		

Tab. 2.c

Digital (DI1 to DI5) and analogue inputs (S1 to S7)

Terminal		Type of inputs	Probe group
26	GND	Multifunction digital input.	-
27	DI5		
28	5Vdc	Multifunction digital input;	4
29	S7/DI4	NTC probe, PTC, PT1000;	
30	GND	0 to 5 Vdc ratiometric probe (power term. 28, 5 Vdc); 0 to 10 Vdc analogue input (external p.s.)*; 4 to 20 mA analogue input (external p.s.)*.	
28	5Vdc	Multifunction digital input;	3
30	GND	NTC probe, PTC, PT1000;	
31	S6/DI3	0 to 5 Vdc ratiometric probe (power term. 28, 5 Vdc).	
30	GND	Multifunction digital input;	2**
32	S5/DI2	NTC probe, PTC, PT1000.	
33	S4/DI1		
34	GND	NTC probe, PTC, PT1000.	1
35	S3		
36	S2		
37	S1		

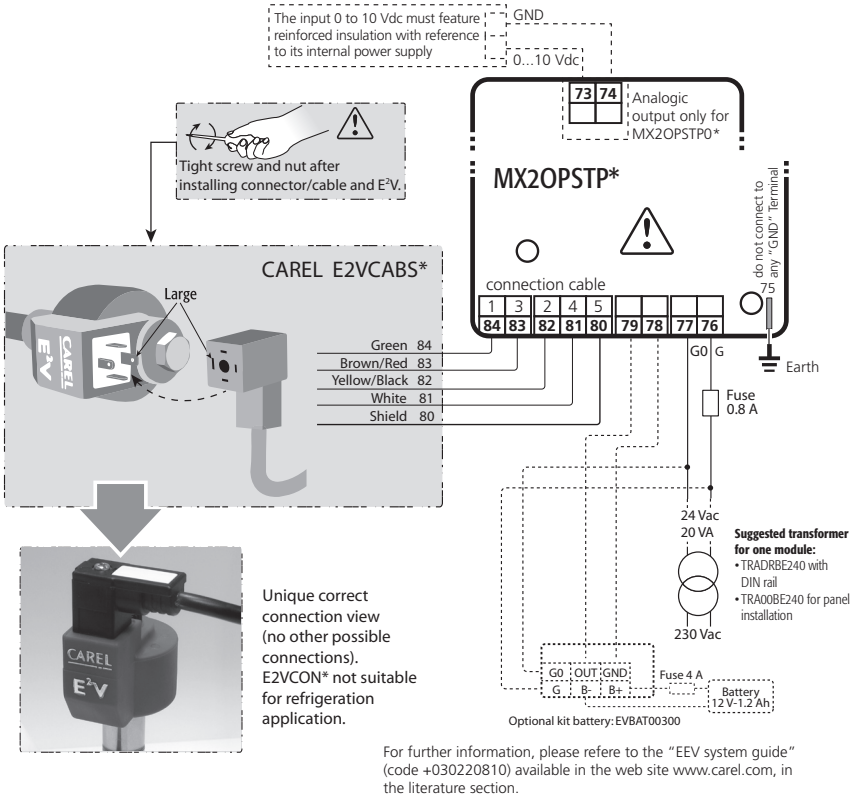
Tab. 2.d

Important:
All the contacts should be galvanically insulated by adding further relays for each contact
The digital inputs must not be connected in parallel, otherwise the board may be damaged.

*N.B.: The devices with 4 to 20 mA or 0 to 10 output Vdc connected to input S7 cannot be powered directly from the MPXPRO. They therefore require an appropriate external power supply.
**Important: The type of input connected to each probe in the same group can be configured by just one parameter. Consequently, for group 1, for example, there is just one parameter that defines the type of input, and that must therefore be the same for all the probes in the same group.
For group 2, despite there being just one parameter, mixed combinations are possible, excepting different types of temperature probes on the two inputs.

2.3 Stepper EEV expansion board wiring diagram (MX2OPSTP*)

Important:
before installing the expansion board, disconnect the power supply and remove the plastic cover.


The input 0 to 10 Vdc must feature reinforced insulation with reference to its internal power supply
GND
0...10 Vdc
73 74
Analogic output only for MX2OPSTP0*
MX2OPSTP*
Tight screw and nut after installing connector/cable and E²V.
do not connect to any "GND" Terminal
75
CAREL E2VCABS*
Large
connection cable
1 3 2 4 5
84 83 82 81 80 79 78 77 76
Green 84
Brown/Red 83
Yellow/Black 82
White 81
Shield 80
G0 G
Earth
Fuse 0.8 A
24 Vac 20 VA
230 Vac
Suggested transformer for one module:
• TRADRBE240 with DIN rail
• TRA00BE240 for panel installation
G0 OUT GND
G B- B+
Fuse 4 A
Battery 12 V-1.2 Ah
Optional kit battery: EVBAT00300
Unique correct connection view (no other possible connections). E2VCON* not suitable for refrigeration application.

For further information, please refere to the "EEV system guide" (code +030220810) available in the web site www.carel.com, in the literature section.

Fig. 2.d

MX2OPSTP* board connections

Terminal	Connection		Function
84	green	CAREL E2VCABS610 cable	Connection to CAREL EEV expansion valve
83	brown/red		
82	yellow/black		
81	white		
80	shield		
79	12 Vbat		Optional battery
78	GND		
77	GO		Power supply
76	G		
75	EARTH		
74	0 to 10 Vdc		0 to 10 Vdc output
73	GND		

Tab. 2.e

Important:
before installing the expansion board, disconnect the power supply and remove the plastic cover.

2.4 PWM expansion board wiring diagram (MX2PPWM*)

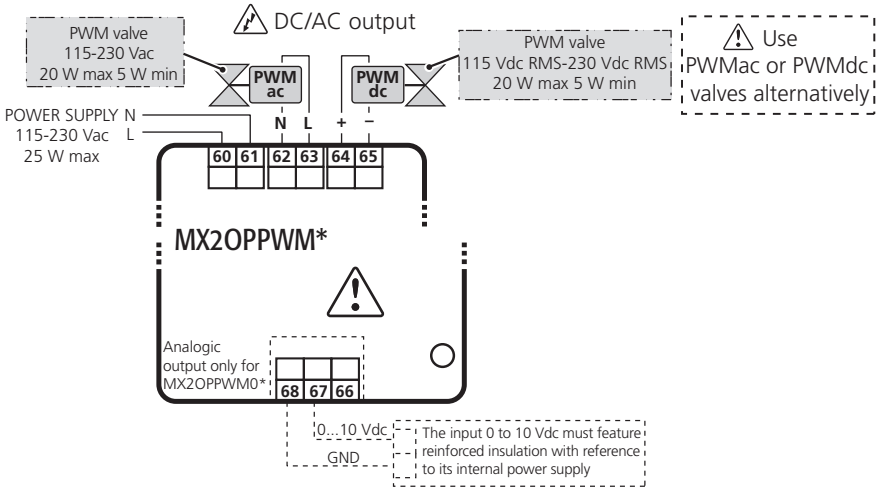

PWM valve 115-230 Vac 20 W max 5 W min
DC/AC output
PWM ac
PWM dc
PWM valve 115 Vdc RMS-230 Vdc RMS 20 W max 5 W min
Use PWMac or PWMdc valves alternatively
POWER SUPPLY 115-230 Vac 25 W max
N
L
N L + –
60 61 62 63 64 65
MX2OPPWM*
Analogic output only for MX2OPPWM0*
68 67 66
0...10 Vdc
GND
The input 0 to 10 Vdc must feature reinforced insulation with reference to its internal power supply

Fig. 2.e

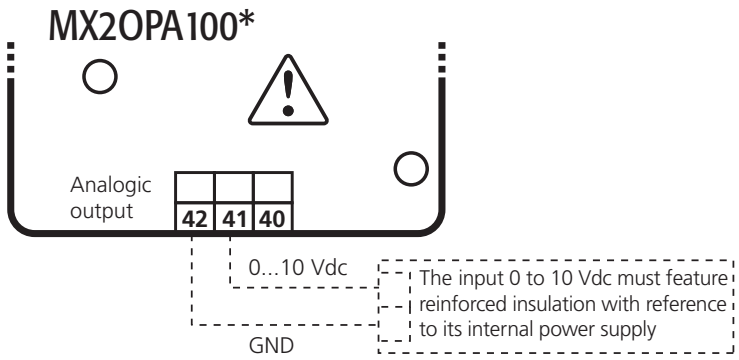
MX2PPWM* board connections

Terminal	Connection	Function
68	GND	0 to 10 Vdc output
67	0 to 10 Vdc	
66	Not used	
65	-	DC PWM valve
64	+	
63	L	AC PWM valve
62	N	
61	N	Power supply
60	L	

Tab.2.f

2.5 0 to 10 Vdc expansion board wiring diagram (MX2OPA100*)

Fig. 2.f



Important:
before installing the expansion board, disconnect the power supply and remove the plastic cover.

MX2OPA100* board connections

Terminal	Connection	Function
42	GND	0 to 10 Vdc output
41	0 to 10 Vdc	
40	Not used	

Tab.2.g

ENGLISH

3. USER INTERFACE

This chapter describes the features and the functions available to display the status and set the parameters of the MPXPRO series controllers.
The basic MPXPRO series interfaces are:
- IR**U*****: display with three digits and function icons.
- IR**X*****: user terminal that, as well as the display, also features a keypad with four buttons for navigating the device function menus.
- Supervision software
- Commissioning tool.

IR**U****

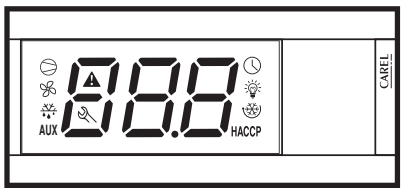


Fig. 3.a

3.1 Display

The IR**U***** display (Fig. 3.a) shows the readings of the probes connected to the controller (see parameter /t1 p. 22 and /t2, p. 38), and the general status of the device, using the corresponding icons. The numeric display can show values in the range -50T150 °C, with decimal resolution in the range -19.9T19.9 °C (see parameter /6, p. 38)

Icons and functions

Icon	Function	Description	Icon meaning / function status		
			On	Off	Flashing
	Compressor	Compressor output status	Active	Not active	Activation delayed by protection times
	Fan	Fan output status	Active	Not active	Activation disabled externally or by procedure in progress
	Defrost	Defrost output status	Active	Not active	Activation disabled externally or by procedure in progress
AUX	Aux	Auxiliary output status	Active	Not active	
	Alarm	Alarm status during normal operation or from digital input	Pre-activation of a delayed external digital alarm	No active alarm	Active alarms
	Clock	RTC option	Control in night-time operation, at start-up comes on to indicate the option is present	Control in daytime operation	Clock alarm
	Light	Local or network light output status	Active	Not active	
	Service	General service signals	On the master indicates the update of the parameters to the slave	No malfunction	Malfunction (System error). Contact service.
HACCP	HACCP	HACCP alarm signal	Function enabled	Function not enabled	HACCP alarm active, signal on the display HA / HF
	Cont. cycle	Continuous cycle function status	On	Off	Request in progress

Tab. 3.a

IR**X****

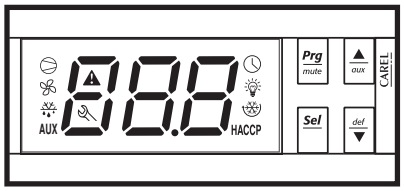


Fig. 3.b

3.2 Keypad and functions

The IR**X***** user terminal (Fig. 3.b) is an interface that as well as the display functions, provides access to the **MPX**PRO parameter configuration menu using the keypad located next to the display. Depending on the type of connection and the configuration of the local network, the entire network can be controlled from just one point. The table below describes the main functions that are immediately obtainable by pressing the specific combination of keys. Further information on the procedures for managing the network and setting the parameters is shown in the following paragraphs.

Category	Function	Keypad controls		Display /Notes
		Buttons	Duration	
Set point	Temperature set point.	**Set**		Set point value flashing
		aux ▲ or def ▼		Change the set point
		Set		Save set point and return to initial display
Access to the parameters	Type F parameters (frequent)	Prg mute	5 s	The first type F parameter is displayed
	Type C parameters (configuration)	Prg mute & **Set**	5 s	
		aux ▲ or def ▼		Enter password (default 22)
		Set		Confirm the password, the first type C parameter is displayed
Exit parameters	Type C parameters (configuration)	Prg mute	5 s	The changes are saved
Defrost	Local defrost	def ▼		dFb: start defrost call dFE: end defrost call
	Multiplexed defrost From master only	**Set** & def ▼	5 s	dFb: start defrost call dFE: end defrost call.
Auxiliary	Continuous cycle	aux ▲ & def ▼	5 s	ccb: start continuous cycle call ccE: end continuous cycle call
	AUX output	aux ▲		
Network functions, master only	Copy parameters from master to slave	Prg mute & **Set**	5 s	
		aux ▲ & def ▼		Enter password (default 66)
		Set		For further info see par. 3.3.4 “Copy parameters from master to slave”
	Display network unit status from master	Prg mute & **Set** & def ▼		Select slave unit, see par. 3.3.2 “Display network unit status from master”
Default	Reset default parameters	Prg mute at start-up		
Alarms	Alarm log	Prg mute & **Set**	5 s	
		aux ▲ & def ▼		Enter password (default 44)
		Set		see par. 3.3.5 Alarm log
	Manual alarm reset	Prg mute & aux ▲		‘rES’: indicates the alarms have been reset*
	Mute buzzer and disable alarm relay **	Prg mute		
HACCP	HACCP menu	Prg mute & def ▼		see par. 3.3.6 HACCP alarms

Tab. 3.b

Note: *Resets the alarm delays ** Disables the slave offline signals for one minute.

3.3 Setting and editing the parameters

The following paragraphs explain Table 3.a: "Functions and associated buttons" and the other modes for setting the **MPX**PRO.

3.3.1 Selecting the network unit (from master unit only)

If using a user terminal connected directly to the master unit, the "select network unit" function can be used to choose the desired unit. After having identified the required setting (e.g. edit parameters, access the alarm log,...), then:

- Scroll the list of slave units available pressing UP or DOWN.
- Press SET to select the desired unit.
- To return to the normal display press PRG.

The control will in any case return to the normal display after a timeout of around 1 minute.
NB: uM indicates the master unit, u1 indicates slave unit 1, u3o indicates unit 3 is offline.
This specific procedure can be managed from the master unit only, if the user terminal is connected to a slave unit the procedure is limited to that slave only.

3.3.2 Displaying the network unit status from the master (Virtual Console)

If using a user terminal connected directly to the master unit, the status of any slave unit can be displayed (as if the terminal were connected to the selected unit). Procedure:

1. Access the "Display network unit status from master" function (see Table 3.b "Buttons and Functions").
2. Scroll the list of units available by pressing UP or DOWN
3. Use SET to select the unit and display the status.
4. The display shows the status of the selected unit, that is, the value shown on the display and the icons refer to the selected unit in the sub-network.
5. To return to the normal display press PRG. The control in any case returns to the normal display after a timeout of 1 min.

The terminal connected to the master unit only allows a general overview of the entire local network.

3.3.3 Modifying the parameters

1. Access the desired configuration menu "Type C parameters" or "Type F parameters" (see Table 3.b "Functions and associated buttons")
2. If using a user terminal connected directly to the master unit, select the unit (see par. "3.3.1 Selecting the network unit").
3. Press UP or DOWN until reaching the desired parameter (the icon for the function will be displayed, together with the parameter). Alternatively: Press PRG to display the menu of parameter categories. Press UP or DOWN until reaching the desired category of parameters and press SET. The list of parameters in the selected category is displayed, then press UP or DOWN until reaching the desired parameter (the display shows the icon that represents the category the parameter belongs to, see Table 3.c).
4. Once having reached the desired parameter, press SET
5. Increase or decrease the value of the parameter using UP or DOWN
6. Press SET to temporarily save the new value and return to the display of the list of parameters to modify other values.
7. If the parameter has sub-parameters, after having selected the parameter as in point 4, press SET again to enter the sub-menu, use the UP or DOWN button to scroll between the sub-parameters, which can be modified like a normal parameter. Press SET again to temporarily save the values and return to the higher level menu.
8. Once all the modifications have been made, to permanently save the new values assigned to the parameters, press PRG for 5 seconds. To ignore the modifications, wait 60 seconds without pressing any button (TIMEOUT).

Parameter categories

Parameter category	Prefix	Display	Icon
Probe	/	'Pro'	
Control	r	'CtL'	
Compressor	c	'CMP'	
Defrost	d	'dEF'	
Alarms	A	'ALM'	
Fans	F	'FAn'	
Expansion valve	E	'Eud'	
Configuration	H	'CnF'	AUX
Log	HS	'HSt'	
HACCP	H	'HcP'	HACCP

Tab 3.c

3.3.4 Copy parameters from master to slave (Upload)

All the parameters can be uploaded from a master unit to the slave units in the sub-network. This procedure can be used instead of the programming key, with the advantage of being able to update all the slave boards in the sub-network at the same time (rather than having to do it individually for each board with the programming key). Procedure:

1. Access the "Copy parameters from master to slave" menu (see Table "3.b Functions and associated buttons")
2. Scroll the list of units available using UP or DOWN
3. Press SET to select the desired unit. Selecting ALL means all the slave units in the sub-network will be programmed.
4. During the programming process, the display on the terminal shows the normal display alternating with the message uPL, and the icon comes on.
5. Once the programming procedure is complete, the message uPL disappears and the icon goes off. In the event of errors, the message uPX is displayed (X= number of the slave unit where the error occurred).

3.3.5 Alarm log

Below are the instructions for managing the alarms saved by **MPX**PRO:

1. Access the "Alarm log" menu (see Table "3.b Functions and associated buttons")
2. If using a master unit, select the desired unit (par. "3.3.1 Selecting the network unit").
3. Scroll the list of alarms by pressing UP and DOWN
4. Select the desired alarm by pressing SET, showing: the alarm code, hours, minutes and duration of the alarm, using the UP and DOWN buttons
5. To return to the list, press SET again
6. To exit the alarms menu, press PRG for 5 seconds, or alternatively wait 60 seconds without pressing any button.

To delete the alarm log, press SET & UP & DOWN for 5 seconds (the display will show the alarms deleted

message, rES).

3.3.6 HACCP alarms

The most recent 6 HACCP alarms (HA/HF) can be displayed and managed inside the HACCP menu.

1. Access the "HACCP menu" (see Table "3.b Functions and associated buttons")
2. If using a master unit, select the desired unit (par. "3.3.1 Selecting the network unit").
3. Scroll the list of alarms by pressing UP and DOWN
4. Press SET to select the desired alarm.
5. Using the UP or DOWN button, view the description of the selected alarm, that is: year, month, day, hours, minutes and duration in minutes.
6. Press SET again to return to the previous list.

In addition, the HACCP alarm menu allows the following operations:

- Delete an individual HACCP alarm by pressing SET & DOWN for 5 seconds when displaying the list of alarms. This causes the HACCP to flash, the display shows the message rES and the monitoring of HACCP alarms is reinitialised.
- Delete the entire memory of HACCP alarms, by pressing SET & UP & DOWN for 5 seconds. This procedure displays the message rES, deletes the entire memory of alarms and reinitialises the monitoring of the HACCP alarms.

4. START-UP

This chapter describes the configuration of the inputs and the outputs suggested by CAREL, as well as the controller start-up procedure to ensure the correct commissioning of the installation.

4.1 Recommended initial configuration

MPXPRO features highly configurable inputs and outputs. CAREL in any case recommends the basic configurationd on the default settings of the parameters. By following this suggestion, the controller can independently manage the main functions in most applications, without having to significantly modify the settings of the parameters. The suggested settings are shown on all the wiring diagrams.

• Initial configuration of the inputs

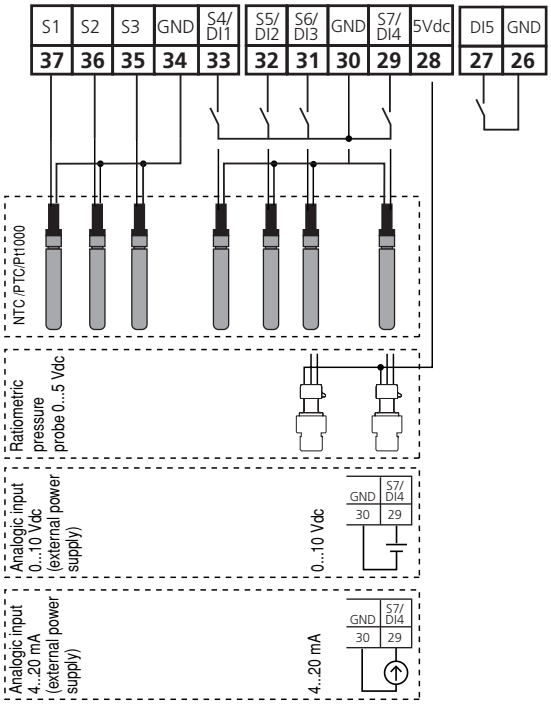

S1 S2 S3 GND S4/DI1 S5/DI2 S6/DI3 GND S7/DI4 5Vdc DI5 GND
37 36 35 34 33 32 31 30 29 28 27 26
NTC /PTC/Pt1000
Ratiometric pressure probe 0...5 Vdc
Analogic input 0...10 Vdc (external power supply)
0...10 Vdc
GND S7/DI4
30 29
Analogic input 4...20 mA (external power supply)
4...20 mA

Fig. 4.a

The default configuration envisages:
- Group 1: pre-configured as NTC cabinet temperature probes
  - S1: NTC outlet probe Sm
  - S2: NTC defrost probe Sd
  - S3: NTC inlet probe Sr
- Group 2: pre-configured as NTC probes, auxiliary temperatures – digital inputs
  - S4: NTC superheated gas temperature probe (only configured on the models with valve driver included, see advanced parameter /Fd)
  - S5: digital input DI2 can be configured (function not configured, see basic parameter A5)
- Group 3: pre-configured as pressure probe
  - S6: ratiometric evaporation pressure probe (only configured on the models with valve driver included, see advanced parameters /P3, /U6, /L6, /FE)
- Group 4: pre-configured as NTC probe
  - S7: function not configured (see Assigning the advanced functions of the probes, p. 42)
- Group 5: pre-configured as DI5 digital input (function not configured, see basic parameter A12)

For further information, see the following sections:
- Basic functions: Temperature probe configuration, p. 21
- Basic functions : Digital input configuration, p. 22
- Advanced functions: Analogue inputs, p. 35
- Advanced: Assigning the advanced functions of the probes, p. 37

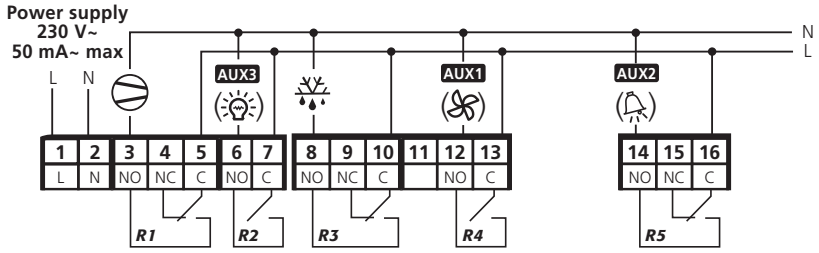


Fig. 4.c

Default configurations:

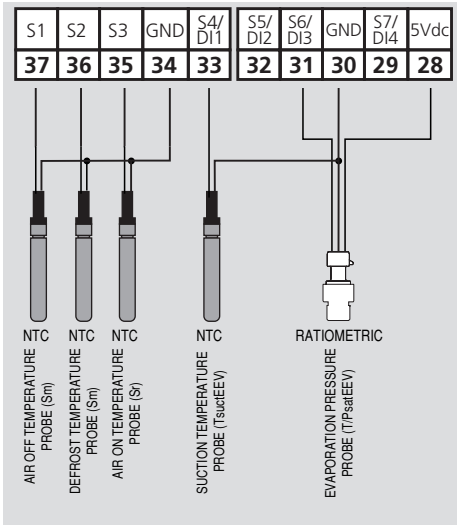

S1 S2 S3 GND S4/DI1 S5/DI2 S6/DI3 GND S7/DI4 5Vdc
37 36 35 34 33 32 31 30 29 28
NTC NTC NTC NTC RATIOMETRIC
AIR OFF TEMPERATURE PROBE (Sm)
DEFROST TEMPERATURE PROBE (Sm)
AIR ON TEMPERATURE PROBE (Sr)
SUCTION TEMPERATURE PROBE (TsuctEEV)
EVAPORATION PRESSURE PROBE (T/PsatEEV)

Fig. 4.b

Important:
The availability of the output depends on the code of the controller, consequently check the hardware before making the connections.

B🛠 A5 A12: Digital input configuration, p. 22
A🛠 /Fd, /FE: Assigning the functions of the probes, p. 37
A🛠 /P3, /U6, /L6: Analogue input configuration p. 35

see Restoring the default parameter settings

ENGLISH

B🛠 H1, H5, H7: AUX output configuration, p. 24
B🛠 Hhu: Hardware configuration, p. 26

NB: Based on the specific application, these parameters may not be useful, for example, if the electronic expansion valve is not used. In these cases, simply confirm the default values set on the controller.

• Initial configuration of the outputs

The default configuration envisages:
Relay 1: solenoid valve / compressor (not modifiable)
Relay 2: light (see basic parameter H7)
Relay 3: heaters defrost (not modifiable)
Relay 4: fans (see basic parameter H1)
Relay 5: alarm (see basic parameter H5)
PWM 1: anti-sweat heaters – hot wire (if present, see basic parameter Hhu p. 26)
PWM 2: not used

• Sets of pre-configured parameters

To further assists the configuration phase, **MPX**PRO features two sets of pre-configured parameters that represent the typical configurations of two specific applications:
• Cabinet 1: NT utility - normal temperature
• Cabinet 2: LT utility - low temperature
These pre-configurations are can be selected using the procedure for loading the default parameters, and then selecting the desired set of parameters.

4.2 Start-up procedure

MPXPRO features a special procedure when first starting that ensures the controller operates in safe conditions. This procedure is designed above all to help the installer when starting an installation in which the devices have not been previously programmed and/or when replacing the controllers in existing systems. In these cases, this procedure avoids problems of conflicts on the supervisor or in the master/slave network and the return of liquid refrigerant to the compressors (very frequent situations when the instruments have not been programmed correctly).
When first powered up, **MPX**PRO runs a procedure that freezes all the functions of the controller and only allows the user terminal to be used to set the parameters that are considered critical for:
• correct communication of the controller with the supervisor;
• management of the electronic valve.
The scope of this procedure does not cover the complete programming of the instrument, but rather the first start-up in safe conditions so as to avoid critical situations and be able to set all the remaining parameters at a later stage on the user terminal or via the supervisor.
During this procedure, the device remains in standby and all the functions are deactivated, the controller consequently does not implement any control functions or communicate with the supervisor. These restrictions end only after having set all the required parameters.

4.3 Device start-up parameters

When first starting the controller, the user terminal does not display the traditional menu, but rather automatically enters a temporary configuration menu that only displays the parameters defined as critical for the initial operation of the installation. By default, the following parameters are displayed:

Code	Application	Description
H0	Supervisor and LAN	Serial / LAN address
In		Unit configuration, Master or Slave
Sn		Number of Slaves connected to the Master
/P2	Electronic expansion valve	Select type of probe, Group 2 (S4-S5 / DI1-DI2)
/P3		Select type of probe, Group 3 (S6 / DI3)
/Fd		Assign evaporator outlet temp. probe
/FE		Assign saturated evaporation temp. probe
/U6		Max. value of sensor S6
/L6		Min. value of sensor S6
P1		Type of valve
PH		Type of refrigerant

Tab.4.a

4.4 Navigation

This menu can be navigated in the traditional manner, through the sub-sets of parameters. To exit the menu press and hold the PRG button, after having set all the parameters displayed. In fact, each individual parameter must be selected using the SET button, the value set correctly using UP or DOWN and saved by pressing the SET button again. The configuration procedure is simplified by the icons being shown on the display corresponding to each parameter that has not yet been set. Only when all the parameters have been set, and consequently the icons corresponding to all the start-up parameters are off, will it be possible to exit this procedure.

4.5 Exceptions

As already mentioned, this procedure is especially useful when starting and programming the installation directly. Nonetheless, the list of parameters displayed can be changed and/or the procedure disabled by programming the parameters via programming key or commissioning tool. For further information, see to the documents on the commissioning tool..

5. BASIC FUNCTIONS

MPXPRO features a vast range of applications and functions for the control and management of refrigeration units. To simplify the use of the functions available, two levels have been identified:
- (B🛠) Basic: simple, standard functions
- (A🛠) Advanced: complex applications and functions, reserved for expert users (see Chap. 6 Advanced functions, p. 34)

The basic functions, described in this chapter, include the typical parameters for entry-level use of the controller. These involve::

5.1 5.1 General configuration (I/O, hardware and LAN)
5.2 Control (set point)
5.3 Defrost
5.4 Fans
5.5 Temperature alarms

Note:
To simplify understanding, the basic and advanced parameters are highlighted by references shown on the side of the page. For example, if the text refers to parameter /FA, the following reference will be shown on the side of the page:

"B🛠 /FA p. 21"

5.1 General configuration

The following paragraph describes the basic configurations relating to:

5.1.2 Temperature probes
5.1.3 Digital inputs
5.1.4 Auxiliary outputs
5.1.5 LAN
5.1.6 Hardware

5.1.1 List of parameters

Code	Parameter
Temperature probes	
/FA	Assign outlet temperature probe (Sm)
/Fb	Assign defrost temperature probe (Sd)
/Fc	Assign intake temperature probe (Sr)
/t1	Select display on the terminal
Digital inputs	
A4	Configure function of digital input DI1 on S4
A5	Configure function of digital input DI2 on S5
A10	Configure function of digital input DI3 on S6
A11	Configure function of digital input DI4 on S7
A12	Configure function of digital input DI5
A7	Delay time for delayed external alarm
Auxiliary outputs	
H1	Configure function of AUX1 output
H5	Configure function of AUX2 output
H7	Configure function of AUX3 output
H9	Select function associated with the AUX button (Light or AUX)
LAN	
In	Select type of unit, MASTER or SLAVE
Sn	Number of slaves in the local network
H0	Serial address
r7	Enable solenoid output on the Master as sole LAN solenoid
Hardware	
Hhu	Hot wire PWM 1 and 2 activation time (on period of 240 seconds)
Htc	Clock option fitted
tc	RTC date/time setting
tS1...tS8, tE1...tE8	Start day details, time band 1 to 8, end day, time band 1 to 8
H8	Select output switched with time bands (Light and Aux)

Tab. 5.a

5.1.2 Temperature probe configuration

/FA /Fb /Fc Assign temperature probes

	Name	UOM	Min	Max	Def
/FA	Assign outlet temperature probe (Sm)	-	0	11	1
/Fb	Assign defrost temperature probe (Sd)	-	0	11	2
/Fc	Assign intake temperature probe (Sr)	-	0	11	3

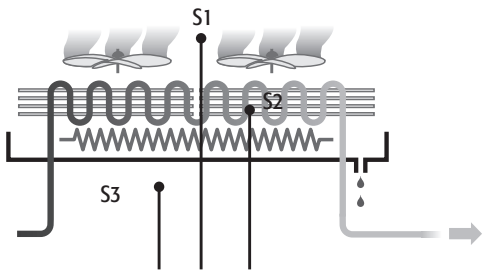
Tab. 5.b

MPXPRO, inside the refrigerated cabinet or the cold room, can use temperature probes to measure:
- the air outlet temperature (at the evaporator outlet);
- the defrost temperature (in contact with the evaporator);
- the air intake temperature (at the evaporator inlet).

The default configuration for the assignment of the probes (typical for CAREL controllers) is the following:
- S1 = Outlet probe (Sm);
- S2 = Defrost probe (Sd);
- S3 = Intake probe (Sr).

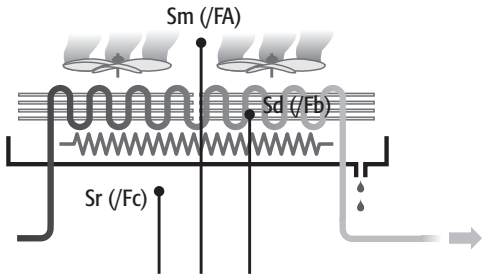
The default configuration also includes three standard CAREL NTC probes. Other types of probes can also be connected, setting parameter /P1, if the product code allows.

MPXPRO allows the default settings to be changed and the function associated with the probes to be selected. In particular, parameters /FA /Fb /Fc are used to assign the cabinet and/or cold room temperature probes:
- /FA: Outlet temperature (Sm)
- /Fb: Defrost temperature (Sd)
- /Fc: Intake temperature (Sr)



Default configuration

A🛠 /P1, general configuration - analogue inputs, p. 35



Regulation probe parameters

Important:
Check the technical specifications of each input in relation to the application that is being implemented, before setting the parameters.

MPXPRO can manage a maximum of 11 analogue probes: 7 can be physically connected to the device and 4 serial probes via the master-slave network. The possible configurations of the parameters and the corresponding meanings are shown in the following table.

/FA /Fb /Fc	Probe associated
0	No probe associated with the function, probe not present
1	S1 (default /FA)
2	S2 (default /Fb)
3	S3 (default /Fc)
4	S4
5	S5
6	S6
7	S7
8	S8 (serial probe)
9	S9 (serial probe)
10	S10 (serial probe)
11	S11 (serial probe)

Tab. 5.c

The default values of parameters /FA, /Fb, /Fc identify a typical application that uses three temperature probes to control the temperature inside the cabinet. There are cases however in which the features of the applications require different settings.
Examples:
Control inside a cold room is normally performed using two temperature probes, specifically the intake temperature is not used. In this case, the possible configuration may be:
- /FA=1: Outlet temperature measured by probe S1 (Sm=S1)
- /Fb=2: Defrost temperature measured by probe S2 (Sd=S2)
- /Fc=0: Intake temperature absent

Alternatively:
- /FA=1: Outlet temperature measured by probe S1 (Sm=S1)
- /Fb=3: Defrost temperature measured by probe S3 (Sd=S3)
- /Fc=0: Intake temperature absent

/t1 Select display on the main terminal

Code	UOM	Min	Max	Def.
/t1	-	0	14	12

A🛠 /t2: Select display on secondary terminal, p. 38

A🛠 A8-A9: Configure function of virtual digital input
Select digital input propagated from Master to Slaves, p. 40

If the device that is being configured has its own main terminal (user terminal with keypad), parameter /t1 can be used to select the probe whose value is displayed during normal operation.

Value of /t1	Probe displayed
0	No probe displayed
1...7	S1 to S7
8...11	S8 to S11 (serial probes)
12	Sreg (Control probe) Default
13	Sv (Virtual probe)
14	Set point

Tab. 5.d

To configure the value shown on a second display, see advanced parameter /t2.

5.1.3 Digital inputs

Based on the configuration of the probes, **MPX**PRO manages up to 5 digital inputs, directly connected to the board, and 1 virtual digital input shared by the master with the slaves across the local network.
The function of each individual input depends on the setting of a specific parameter. The following are used parameters to set the functions of the digital inputs:

Parameter	DI
A4	DI1
A5	DI2
A10	DI3
A11	DI4
A12	DI5

Tab. 5.e

For the configuration of the virtual digital input, refer to parameters A8 and A9.
The possible functions are identical for each digital input.

A4 - A5 - A10 - A11 - A12 Digital input configuration

Code	Name	UOM	Min	Max	Def.
A4	Configure function of digital input DI1 on S4	-	0	7	0
A5	Configure function of digital input DI2 on S5	-	0	7	0
A10	Configure function of digital input DI3 on S6	-	0	7	0
A11	Configure function of digital input DI4 on S7	-	0	7	0
A12	Configure function of digital input DI5	-	0	7	0

Tab 5.f

Below is the list of the functions that can be associated with each individual digital input.

A4, A5,A10, A11, A12	Function	⎍	⎍
0 (default)	Input not used	-	-
1	Immediate external alarm	Active	Inactive
2	Delayed external alarm / display only	Active	Inactive
3	Enable defrost	Not active	Active
4	Defrost call	Not active	Active
5	Door switch	Door open	Door closed
6	Remote ON/OFF	OFF	ON
7	Curtain switch/light	Day status	Night status

Tab. 5.g

Input not used (default): A4-A5-A10-A11-A12 = 0
Immediate external alarm: A4-A5-A10-A11-A12 = 1

⎍	immediate external alarm active
⎍	immediate external alarm not active

The activation of the alarm causes:
- the message IA to be shown on the display and the ⚠ icon to flash,
- the activation of the buzzer (to modify this function, see advanced parameter H4),
- the activation of the alarm relays (if configured, see basic parameters H1-H5-H7),
- the deactivation of the compressor/solenoid output (to modify this function, see advanced parameter).

Note: the activation of the external alarm shuts down the fans only if these follow the status of the compressor output, as set using basic parameter F2.
The shutdown of the compressor due to an external alarm ignores the compressor ON time (advanced parameter c3).

A4-A5-A10-A11-A12 = 2: Delayed external alarm / display only
The operation of this alarm depends on the setting of parameter A7 (external alarm delay):
- A7=0: signal only alarm on the display, no change to the normal operation of the controller (default)
- A7≠0: alarm similar to the immediate external alarm, the activation is delayed by the time set for A7

A4-A5-A10-A11-A12 = 3: Enable defrost

⎍	defrost not enabled (inhibited)
⎍	defrost enabled

This is used to disable any defrost calls. When the contact is open, all the defrost calls are ignored.
Note:
- if the contact is open while a defrost is in progress, this is immediately stopped ❄ flashes on the display indicating the defrost call is active (this starts again when the contact closes).
- This function may be useful to prevent defrosts on units exposed to the public during the shop opening hours, and to be able to perform special hot gas defrosts.

A4-A5-A10-A11-A12 = 4: Start defrost

⎍	no defrost call
⎍	defrost call

The closing of the digital contact starts the defrost, if enabled. If the controller is the master, the defrost will be a network defrost, while if it is a slave, it will only be a local defrost.
Note:
- If the defrost is inhibited by another digital input configured as "enable defrost", the defrost calls are ignored;
- If the digital contact for the defrost call is connected in parallel to a series of **MPX**PRO,controllers, the defrosts on the various showcases can be staggered (see advanced parameter d5).

A4-A5-A10-A11-A12 = 5: Door switch
This function is useful when MPXPRO is used to control check a cold room, and specifically to manage the contact on the door.

⎍ Door open
Stop control (shutdown compressor/solenoid and evaporator fans),
- Switch light on (if configured, see basic parameters H1-H5-H7),
- ⚠ flashing on the display,
- Disable temperature alarm.

⎍ Door closed
- Restart control
- Switch light off (if configured, see basic parameters H1-H5-H7)
- ⚠ stops flashing on the display
- Enable temperature alarm after bypass time defined by basic parameter d8

Note:
- When resuming control, the compressor protection times are observed (advanced parameters, compressor)
- If the door remains open for a time greater than the value set for parameter d8, control is resumed in any case. The light remains on, the value shown on the display flashes, the buzzer and the alarm relay are activated, and the temperature alarms are enabled, with the related time.

A🛠 H4: General configuration, p. 39
B🛠 H1-H5-H7: General configuration, p. 24
A🛠 A6 Solenoid control configuration during external alarm (immediate or delayed) p. 52
B🛠 F2: Enable fan stop with control off, p. 31
A🛠 c3: Minimum On time p. 52

A🛠 A7 - Delay time for delayed external alarm, p. 24

A🛠 d5: Defrost delay on start-up if enabled, p. 53

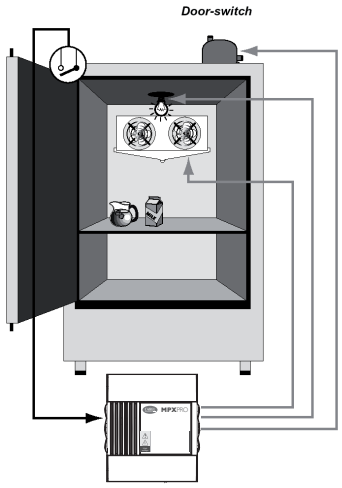
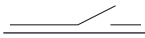
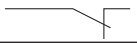


Fig. 5.a

B🛠 H1-H5-H7 - AUX output configuration, p. 24
B🛠 d8: Alarm bypass after defrost and door open, p. 30

A4-A5-A10-A11-A12 = 6: Remote ON/OFF

	Remote OFF
	Remote ON

When the controller is OFF:
1. the display shows the value measured by the probes set (basic parameter /t1) alternating with the message OFF;
2. the auxiliary relays set as AUX and light remain active, while the other auxiliary outputs are deactivated;
3. the buzzer and alarm relay are deactivated;
4. the following are not performed: control, defrosts, continuous cycle, temperature alarm signals;
5. the compressor protection times are observed.

When the controller is ON again, all the functions are reactivated, except for the defrost on start-up and the compressor/fan delay on power-up.

B🛠 dI: Interval between consecutive defrosts, p. 29

Note:
- If more than one input is configured as the remote ON/OFF, the off status of one any of these determines the off status of the device;
- The ON/OFF control from digital input has priority over the keypad and the supervisor;
- If the controller remains OFF for longer than the value set for basic parameter dI, when the instrument is switched back on a defrost is performed.

A4-A5-A10-A11-A12 =7: Curtain switch/light

	Day status
	Night status

During night status
1. the night-time set point Stn is used for control, calculated based on the set point St plus the offset defined by basic parameter r4 (Stn = St + r4). In addition, if the control probe has been modified according to the configuration of basic parameter r6;
2. the AUX or LIGHT output is deactivated based on the setting of basic parameter H8.

B🛠 St: Unit set point, p. 27
B🛠 r4-r6: Automatic set point variation in night status - Enable control on intake probe (Sr) at night, p. 28
B🛠 H8: Select output switched with time bands (light and AUX), p. 27

During day status
1. Normal operation resumes: set point = St, virtual probe used as control probe;
2. Activation of the AUX or LIGHT output, based on setting of parameter H8.

A7 Delay time for delayed external alarm

Code	UOM	Min	Max	Def.
A7	min	0	240	0

Sets the delay for the activation of the external alarm from digital input (A4 to A12=2)

5.1.4 Auxiliary outputs

MPXPRO features a maximum of 5 digital outputs. Two of these, in particular relay 1 (R1) and relay 3 (R3), are related respectively to the management of the compressor / solenoid valve and the defrost.
- R1 = Compressor / Solenoid
- R3 = Defrost

Their configuration cannot be modified on the keypad or via the supervisor. To change this setting, use the programming key or the commissioning tool (see "Chap. 7 Programming key and Commissioning tool", p. 61).
The other three auxiliary outputs, in their default configuration, have the following functions:

Output	Relay	Parameters	Default functions
AUX 1	4	H1	
AUX 2	5	H5	
AUX 3	2	H7	

Tab. 5.h

H1,H5, H7 Configure AUX output functions

	Name	UOM	Min	Max	Def.
H1	Auxiliary output AUX 1 configuration	-	0	8	8
H5	Auxiliary output AUX 2 configuration	-	0	8	2
H7	Auxiliary output AUX 3 configuration	-	0	8	5

Tab 5.i

Each auxiliary output can be configured to carry out the following functions:

H1, H5, H7	Function output
0	not configured
1	normally open alarm
2	normally closed alarm
3	auxiliary output
4	master remote auxiliary output
5	light
6	master remote light
7	auxiliary evaporator defrost
8	fan

Tab. 5.j

NO alarm (normally open) - H7-H5-H7 = 1
The digital output is normally open, it is closed when an alarm is activated.

NC alarm (normally closed) - H1-H5-H7 = 2
The digital output is normally closed, it is opened when an alarm is activated. This guarantees maximum safety as the alarm is also activated in the event of power failures or disconnection of the cables.

AUX auxiliary output - H1-H5-H7 = 3
The auxiliary output is activated when the controller switches from night status to day status, and is deactivated when switching back (curtain switch or time bands). It can be activated/deactivated manually using the ▲ aux button (if basic parameter H9=1) or from the supervisor.

AUX master remote auxiliary output - H1-H5-H7 = 4
This can only be configured on the slaves. It allows the auxiliary output on a slave to repeat the same operation as the auxiliary output on the master. With this configuration, for example, AUX3 on a slave can exactly replicate the behaviour of AUX3 on the master.

Light - H1-H5-H7 = 5
Auxiliary output for the connection of the lights inside the cabinet or the cold room. It is activated when the controller switches from night status to day status, and is deactivated when switching back (curtain switch or time bands). It can be activated/deactivated manually using the ▲ aux button (if parameter H9=0).

Master remote light - H1-H5-H7 = 6
This can only be configured on the slaves. It allows the auxiliary output on the slave to repeat the same operation as the LIGHT output on the master.

Auxiliary defrost evaporator - H1-H5-H7 = 7
This is activated to power a heater or reverse the cycle to perform a heater or hot gas defrost on the second evaporator.

Fan - H1-H5-H7 = 8
Auxiliary output for the connection of the fans on the evaporator, the management of the output in this configuration depends on the parameters described in the fan section (p. 30 and 56).

H9 Select function associated with the AUX button

Code	UOM	Min	Max	Def.
H9	-	0	1	0

This is used to select the function associated with the ▲ aux button on the user terminal keypad.
- H9 = 0 light output (default)
- H9 = 1 output AUX

5.1.5 LAN
Below are details of the parameters for the basic configuration of a LAN (made up of a master unit and up to 4 slaves).

In Select type of unit, Master or Slave

Code	UOM	Min	Max	Def.
In	-	0	1	1

This is used to select whether the unit is a master or a slave.
- In = 0 slave unit (default)
- In = 1 master unit

Sn Number of slaves in the local network

Code	UOM	Min	Max	Def.
Sn	-	0	4	0

This can only be configured on the master unit. It indicates how many slaves are connected in the sub-network of the master. Default: Sn=0 (stand-alone master unit).

H0 Indirizzo seriale

Code	UOM	Min	Max	Def.
H0	-	0	199	199

The value of H0 has different meanings depending on the type of controller (master/slave):
- MASTER: H0 indicates the network address of the device for the supervisor. This must be unique within the entire RS485 supervisor network.
- SLAVE: H0 indicates the address of the slave inside the LAN. In this case, the address of the device for the supervisor is the sum of the serial address of the master and the number of the slave, according to the formula:

Serial address = H0 master + H0 slave

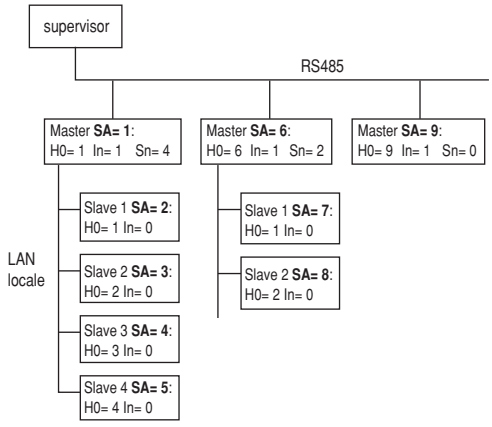
N.B.: On the slaves, H0 can be set between 1 and 4

B🛠 H9: Select function associated with AUX button, p. 25

On Slave unit only

A🛠 d/2: Defrost probe on second evaporator, p. 54

Example of assigning parameters In, H0, Sn:
Important: avoid conflicts in the supervisor addresses between different controllers.


supervisor
RS485
Master SA= 1: H0= 1 In= 1 Sn= 4
Master SA= 6: H0= 6 In= 1 Sn= 2
Master SA= 9: H0= 9 In= 1 Sn= 0
Slave 1 SA= 2: H0= 1 In= 0
Slave 2 SA= 3: H0= 2 In= 0
Slave 3 SA= 4: H0= 3 In= 0
Slave 4 SA= 5: H0= 4 In= 0
Slave 1 SA= 7: H0= 1 In= 0
Slave 2 SA= 8: H0= 2 In= 0
LAN locale

SA: Serial address

Fig. 5.b

Important: r7 is only set on the master

r7 Enable solenoid output on the Master as sole LAN solenoid

Code	UOM	Min	Max	Def.
r7	flag	0	1	0

Indicates whether just one solenoid valve connected to the master has been installed in the master-slave network, or there is a solenoid valve for each slave:
- r7 = 0 one solenoid valve for each unit (default);
- r7 = 1 one shared network solenoid valve.

The network solenoid valve is controlled in parallel between all controllers in the sub-network: if at least one is called, this is opened, while it is closed only when all the units are at the set point or defrosting. The network solenoid valve can also be closed in special cases when alarms LSH, LSA and MOP are activated on any of the units in the sub-network, see P10 and PM5.
Important: Before activating a specific alarm, MPXPRO enters a special status that depends on the type of alarm, attempting to restore operation by modulating the electronic valve. In these situations, the LSH, LSA, MOP status of a unit and the simultaneous closing of the expansion valve (0 steps with hysteresis of 10 steps), also closed the local solenoid, while all controllers in the master-slave sub-network must be in these conditions to close the network solenoid valve.

5.1.6 Hardware

Hhu Hot wire PWM 1 and 2 activation time (on period of 240 seconds)

Code	UOM	Min	Max	Def.
Hhu	-	0	240	240

This determines the percentage of activation of the output used for the anti-sweat hot wire on the display cabinets (trim heater). It is a fixed parameter that is used to statically modulate the PWM output (if available on the board) in a maximum period of 240 seconds. Default Hhu = 240 s (hot wire always active).

Important:
This cannot be set to 0 with the RTC installed
For details on navigation inside the sub-menus and saving the parameters, see p. 17

Htc Clock option fitted (RTC)

Code	UOM	Min	Max	Def.
Htc	-	0	1	0

Indicates whether or not the real time clock is fitted.
- Htc = 0 the clock is not fitted
- Htc = 1 the clock is fitted

SIf the parameter is set to 0 and the operator physically installs the optional real time clock board (MX2OP48500), when restarting the unit parameter is automatically set to 1. If set to 1 without the clock option being fitted, the 'rtc' alarm is activated.

tc Real Time Clock date/time setting (RTC)

This is used to set the date and time of the Real Time Clock (RTC). Selecting the parameter with the button shows the various sub-parameters is sequence. To set date/time RTC:

	Description / Sub-parameter	UOM	Min	Max	Def.
tc		-	-	-	-
	y*	Year	00	99	00
	M*	Month	1	12	1
	d*	Day	1	31	1
	u*	(*)	1	7	6
	h*	Hour	0	23	0
	n*	Min	0	59	0

Tab. 5.k

(*) indicates the day of the week: 1=Monday, 2=Tuesday,..., 7=Sunday

Important: Setting the start time of a time band only (or the end time only) means that the controller remains permanently in Day or Night status.

Default:d*, h*, m*=0: no band enabled

Note: The changes to these parameters have effect immediately, that is, they are saved directly when exiting the parameter by pressing the SET button.

tS1 to tS8; tE1 to tE8 Day and night status time bands

Code	Description / Sub-parameter	UOM	Min	Max	Def.
tS1...tS8	Start time band *	-	-	-	
	d*	days (*)	0	11	0
	h*	hour	0	23	0
	m*	min	0	59	0
tE1...tE8	End time band *	-	-	-	-
	d*	days	0	11	0
	h*	hour	0	23	0
	m*	min	0	59	0

Tab. 5.l

(*)The days 'd*' in the bands correspond to:

d*	days
0	no days
1...7	Monday to Sunday
8	Monday to Friday
9	Monday to Saturday
10	Saturday & Sunday
11	Every day

Tab. 5.m

MPXPRO manages a maximum of 8 time bands. These can be useful to simultaneously manage daily closing times, weekly closing times, weekends, etc.
In particular, when switching from Day status to Night status, the following actions are possible:
- disattivare l'uscita LUCE o AUX secondo quanto impostato dal parametro base H8;
- icontrol with night-time set point Stn = St + r4 equal to the sum of the current set point and the night-time offset r4 (see basic parameter r4 p. 28);
- only use the intake probe as the control probe (see parameter r6 p. 28).

When switching back from Night status to Day status, the controller resumes standard operation.
Parameter tS* sets the start of the time band, parameter tE* sets the end of the same band. Each of these parameters, if selected with the ***Set*** , button, contains a sub-menu that is used to set the day, hours and minutes of the specific event. In detail, the sub-menus can be navigated with the $\frac{\blacktriangle}{aux}$ or $\frac{def}{\blacktriangledown}$ buttons to set:
- d*: the days the band is activated, according to the table on the side
- h* : the hour the band is activated
- m* : the minute the band is activated

H8 Select output switched with time bands (Light and AUX)

Code	UOM	Min	Max	Def.
H8	flag	0	1	0

This is used to associate Day status and Night status with a specific auxiliary output, which must have already been configured by parameters H1, H5, H7. Specifically:
- H8 = 0: Switching from Day status to Night status deactivates the auxiliary output configured as the LIGHT (default), and vice-versa.
- H8 = 1: Switching from Day status to Night status deactivates the auxiliary output configured as AUX, and vice-versa

If no auxiliary output is configured, the change in status only changes the working set point and the control probe, where set, as described previously.

B🛠 H8: Select output switched with time bands (light and AUX), p. 27

B🛠 r4 and r6 : Automatic set point variation in night status - Enable control on intake probe (Sr) at night, p. 28

Important:

	day	active
AUX	inactive	attiva
LIGHT	active	inactive

B🛠 H1-H5-H7: Configurazione funzioni uscite AUX, p. 24

5.2 Control

MPXPRO features different modes for controlling the temperature inside the cabinet or cold room. This section describes the basic parameters to set a standard configuration of the controller, in particular:
5.2.2 Temperature set point
5.2.3 Night-time set point management

A🛠 Advanced control parameters, p. 34

5.2.1 List of parameters

Code	Parameter
Set point	
St	Unit set point
rd	Temperature set point differential
/4	Virtual probe composition (Sv)
Night-time set point management	
r4	Automatic night-time set point variation
r6	Enable night-time control on intake probe (Sr)

Tab. 5.n

5.2.2 Temperature set point

To determine the control status, **MPX**PRO compares the value read by the control probe (Sreg) against the set point and the differential rd (see Fig. 5.c).
For advanced control applications, see chapter 6 "Advanced functions".

St Unit set point

Code	UOM	Min	Max	Def.
St	°C/°F	r1	r2	50.0

This establishes the value of the set point, the desired temperature inside the cabinet/cold room, used for control in day mode.

rd Temperature set point differential

Code	UOM	Min	Max	Def.
rd	°C/°F	0.1	20.0	2.0

This determines the controller operating cycle. It is summed to the value of St, set as above, to determine the control status.
If the temperature measured by the control probe exceeds the sum of the set point (St) and the differential (rd) ⟹ control ON.
If the temperature measured is less than the set point (St) ⟹ control OFF
In the transitions within the band set by rd, the controller remains in the previous status.
Low values of rd mean:
- Precise control
- High switching frequency (control On/Off

High values of rd mean:
- Less precision
- Low switching frequency (control On/Off) in response to minimum deviations in the temperature.

For further information on the compressor protection parameters, see the compressor parameters, chapter 6 "Advanced functions".

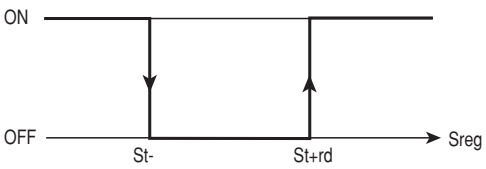


Fig. 5.c

Advanced functions, Double thermostat, p. 42

A🛠 Advanced compressor functions, p. 51

B🛠 r6: Enable control on intake probe (Sr) at night, p. 28

Example
/4=50

$$Sv = \frac{Sm \bullet (100 - 50) + Sr \bullet 50}{100} = \frac{Sm + Sr}{2}$$

Example
/4=75

$$Sv = \frac{Sm \bullet (100 - 75) + Sr \bullet 75}{100} = \frac{1}{4}Sm + \frac{3}{4}Sr$$

B🛠 A4-A5-A10-A11-A12: Digital input configuration, p. 22
B🛠 tS1...tS8, tE1...tE8: Day and night time bands, p. 26

Example of automatic set point variation in night-time operation:
St= -20 °C
r4= 5 °C
Stn= St+r4= -20+5= -15 °C

/4 Virtual probe composition (Sv)

Code	UOM	Min	Max	Def.
/4	-	0	100	0

The virtual probe is the control probe used by **MPX**PRO during standard operation. For the alternative functions, see basic parameter r6 or in paragraph 6.2 "Control", p. 41.
Parameter /4 is used to assign the virtual probe (Sv) to the value read by the outlet probe (Sm), the intake probe (Sr) or a weighted average of the two values.
Depending on the value set for /4 (1 to 99), the reading of Sv may be closer to Sm or to Sr..

/4	Virtual probe composition Sv	
0	Sv = Sm	virtual probe (Sv) = Outlet probe (Sm)
1…49	Sv = (Sm>Sr)	virtual probe (Sv) = Outlet probe (Sm) > Intake probe
50	Sv = (Sm=Sr)	virtual probe (Sv) = Outlet probe (Sm) = Intake probe
51…99	Sv = (Sm<Sr)	virtual probe (Sv) = Outlet probe (Sm) < Intake probe
100	Sv = Sr	virtual probe (Sv) = Intake probe (Sr)

Tab. 5.o

The control probe, in the most common applications, coincides with the virtual probe (Sv) set using parameter /4. It may be different in the event of night-time set point management or the double thermostat function. With control ON, the compressor/solenoid output and the management of the electronic valve, where featured, are activated.

Note:
The following formula is used to calculate the value of the virtual probe:

$$Sv = \frac{Sm \bullet (100 - /4) + Sr \bullet /4}{100}$$

5.2.3 Night-time set point management

MPXPRO can change the temperature set point at night (useful for energy saving). Night-time operation can be activated by:
- curtain switch (curtain down), basic parameters A4-A5-A10-A11-A12
- night time bands, parameters tS1 to tS8, tE1 to tE8

Therefore, based on the settings of parameters r4 and r6 relating to night-time set point management, control will be different during the day and at night, according to the table below.

Variable	Day mode	Night mode	
		r6=0	r6=1
Control probe (Sreg)	Virtual probe (Sv)	Virtual probe (Sv)	Intake probe (Sr)
set point	set point (St)	St+r4	

Tab. 5.p

r4 Automatic set point variation in night-time operation

Code	UOM	Min	Max	Def.
r4	°C/°F	-50.0	50.0	0.0

In night mode **MPX**PRO automatically increases the set point, as determined by parameter St, by the offset set for r4. The new reference night-time set point Stn is therefore:

$$St_n = St + r4$$

If r4 is negative, in night mode the control decreases the standard set point.
r4=0 (default): No variation in night mode.

r6 Enable night-time control on intake probe (Sr)

Code	UOM	Min	Max	Def.
r6	Flag	0	1	0

This is used to modify the configuration of the control probe (Sreg) during night mode
- r6 = 0 Control probe (Sreg) = Virtual probe (Sv)
- r6 = 1 Control probe (Sreg) = Intake probe (Sr)

5.3 Defrost

MPXPRO manages the most common defrost modes. This section describes the basic configuration, regarding:
- type of defrost,
- features of the defrosts,
- times and alarms,
- programmed defrosts.

5.3.1 List of parameters

Code	Parameter
d0	Select type of defrost
dI	Interval between consecutive defrosts
dt1	End defrost temperature (read by Sd)
dP1	Maximum defrost duration
d8	Bypass time high temperature alarm after defrost and door open
td1…td8	Defrost events 1 to 8
d/1	Display defrost probe

Tab. 5.q

5.3.2 Defrost parameters

d0 Select type of defrost

Code	UOM	Min	Max	Def.
d0	-	0	4	0

This establishes the defrost mode:

d0	type of defrost
0	heater by temperature (+ safety time)
1	hot gas by temperature (+ safety time)
2	heater by time
3	hot gas by time
4	heater by time with temperature control

Tab. 5.r

The defrosts available can be divided by type and the way they end.
The combination of these variables determines the different types of defrost.

By type:
- Heater defrost: the output configured as the defrost is activated to power the heaters on the evaporator. At the same time, control is stopped.
- Hot gas defrost. First the evaporator is emptied of refrigerant. Then the defrost output is activated to gradually inject hot gas, using another support solenoid valve. The two actions are not separated time-wise.

By end mode:
- By temperature: the defrosts end when the defrost probe reading exceeds the threshold set using basic parameter dt1. If the evaporator does not reach the set threshold within the maximum period set for basic parameter dP1, the defrost is terminated due to the maximum time being reached. Note: the display of error message Ed1 for end defrost by maximum time depends on advanced parameter r3 (Ed2 if two evaporators are managed, see "Advanced parameters – Defrost – Second evaporator").
- By time: when there is no defrost probe, the defrosts can end after a maximum time, dP1. No end defrost error messages due to maximum time are signalled.
- Heater by time with temperature control: heater defrost, end by time, the defrost output is only activated when the temperature measured by the defrost probe is less than the end defrost temperature threshold (basic parameter dt1). This function is useful for energy savings.

BdP1 and dt1: Maximum defrost duration - Defrost events, p. 30

Ar3: Enable end defrost signal for time out, p. 58

dI Interval between consecutive defrosts

Code	UOM	Min	Max	Def.
dI	ore	0	240	8

Safety parameter used to perform cyclical defrosts every "dI" hours, even without the Real Time Clock (RTC). The action of dI is deactivated with the RTC settings, however is activated if the RTC is not working. It is also useful if the LAN or RS485 serial network is disconnected.
At the end of each defrost, irrespective of the duration, the interval dI starts being counted. If this interval reaches the value set for the parameter without a defrost being performed by other events (RTC, manually by button or supervisor, physical or virtual digital input), a defrost is started immediately. This count is always active even if the controller is off (logical OFF). If set on a slave unit, it has effect only on this unit, independently from the others, while if set on a master it has effect on all the sub-LANs connected.
dI=0 ⟹ safety disabled, only the programmed or forced defrosts are performed (see Fig 5.d).
Note: The time base of the interval can be changed using advanced parameter dC.

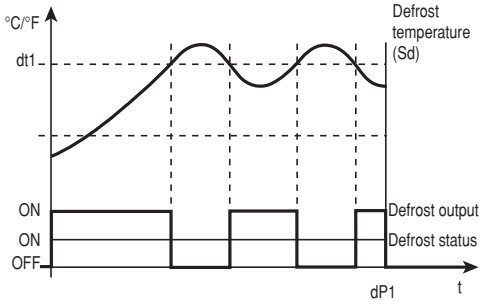


Fig. 5.d

AdC: Defrost time base, p. 53

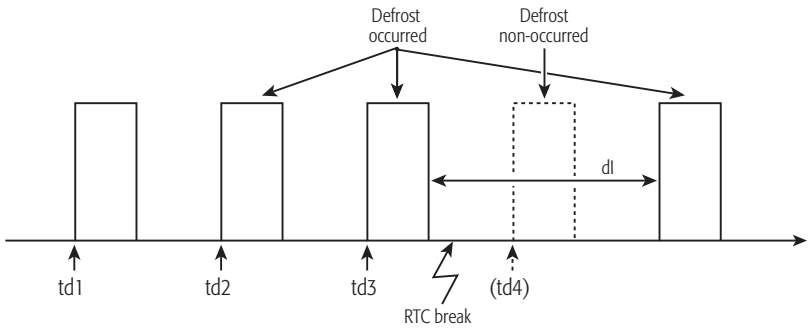


Fig. 5.e

dt1 End defrost temperature (read by Sd)

Code	UOM	Min	Max	Def.
dt1	°C/°F	-50.0	50.0	8.0

For the defrost by temperature with temperature control only.
Indicates the end defrost temperature measured by the defrost probe (Sd) installed on the evaporator. If this temperature is not reached, the defrost ends in any case after the maximum time dP1.
This temperature is also checked at the start of each defrost, both local and network, therefore if when the local defrost is called the temperature measured by the defrost probe (Sd) is greater than the threshold dt1, the defrost is not started. If the call comes from the network, the defrost on that unit is considered completed and subsequent dripping and post-dripping phases are started.

	Defrost call	
	Local	Network
Sd < dt1	Start Local defrost	Start Network defrost
Sd > dt1	Local defrost not performed	Dripping and post-dripping only

Tab. 5.s

dP1 Maximum defrost duration

Code	UOM	Min	Max	Def.
dP1	min	1	240	45

Depending on the type of defrost set, dP1 can have the following values:
- Defrost by time: dP1= normal defrost duration
- Defrost by temperature: dP1= maximum defrost duration (with alarm generated)

Note: To change the time base, see advanced parameter dC

A🛠 dC: Defrost time base, p. 53

d8 Alarm bypass time after defrost and door open

Code	UOM	Min	Max	Def.
d8	min	0	240	30

This indicates the time, in minutes, that the high temperature alarm signals is disabled for, at the end of a defrost or when the door is opened, if the multifunction input is connected to the "door switch" (see basic parameters A4, A5, A10, A11, A12). In an alarm situation, when d8 expires, the alarm is signalled after the time set for A6.

B🛠 A4-A5-A10-A11-A12: Digital input configuration, p. 22
B🛠 A6: Solenoid valve configuration during external alarm (immediate or delayed), p. 52

td1 to td8 Defrost events 1 to 8

Code	Description / Sub-parameter	UOM	Min	Max	Def.
td1...td8	Details of defrost events 1 to 8	-	-	-	-
	d*	day	0	11	0
	h*	hour	0	23	0
	n*	min	0	59	0
	P*	flag (*)	0	1	0

Tab. 5.t

Table of d* values (day settings)

d*	days
0	no days
1...7	Monday to Sunday
8	Monday to Friday
9	Monday to Saturday
10	Saturday & Sunday
11	Every day

(*) **Note:** the attribute 'P' determines a power defrost (see Chap. 6 advanced parameters, power defrost). This function is disabled by defaul.

MPXPRO manages up to 8 defrost time bands, each of which can be set at a precise moment (day, hour and minute)
To set a defrost time band):
- identify a defrost band (e.g. td1) and press SET
- set the parameters, day (d*) hours (h*) minutes (m*) using UP or DOWN and press SET to temporarily save the setting
- at the end of the operation press PRG to confirm and save.

A🛠 Power defrost, p. 56

d/1 Display defrost probe

Code	UOM	Min	Max	Def.
d/1	°C/°F	-	-	-

Parameter that displays the value measured by the defrost probe (Sd) if fitted and configured. Otherwise, three horizontal dashes "___" are displayed.
Important: the default values (d=0, h=0, m=0) indicate no defrost is programmed.

5.4 Fans

MPXPRO manages the activation and deactivation of the fans in relation to the operation of the system (normal operation, defrost, dripping…), the evaporator temperature and the status (on/off) of the compressor. **MPX**PRO, compared to previous models, can also manage the operation of the fans in relation to the virtual probe.

5.4.1 List of parameters

Code	Parameter
F0	Configure fan management
F1	Fan control temperature threshold (only if F0=1 or 2)
F2	Enable stop fans with control off
F3	Stop fans during defrost
Fd	Post-dripping time after defrost (fans on with control on)
Frd	Temperature control differential (including variable speed)

5.4.2 Fan parameters

F0 Fan management

Code	UOM	Min	Max	Def.
F0	-	0	2	0

The evaporator fan can be managed in three different modes:
- Management irrespective of the temp. inside the cabinet and the evaporator temp. (F0=0)
- Management depending on both the temp. inside the cabinet and the evaporator temp. (F0=1)
- Management depending on the evaporator temperature only (F0=2)

Based on the configuration, in particular if the fans are managed according to the temperature, the following basic parameters need to be set:
- F1= fan start temperature
- Frd = differenziale ventilatori

MPXPRO based on the configuration, manages the status of the fans according to the table below:

F0	Function	Condition	Fan status
0	Fans without temperature control	F2 = 0	Fans always on
		F2 = 1	Fans off if control off
1	Fans controlled based on the evaporator temperature and virtual probe	Sd - Sv < F1 - Frd	Fans on
		Sd - Sv > F1	Fans off
2	Fans controlled based on evaporator temperature only	Sd < F1-Frd	Fans on
		Sd > F1	Fans off

Tab. 5.u

Where:
- F1 = basic parameter "Fan start temperature"
- F2 = basic parameter "Stop fans with compressor off"
- Frd = basic parameter "Fan differential"
- Sd = temperature measured by the defrost probe (basic parameter /Fb)
- Sv = temperature measured by the virtual probe (basic parameter /4)

If F0 = 0 the fans are not controlled based on the temperature.
If F0 = 1 the fans are controlled based on the virtual probe and the evaporator temperature, according to the graph on the side. This status refers to the normal operation of the device, that is, when MPXPRO is not in specific modes such as: defrost, dripping, post-dripping. In fact:
- the status of the fans can be forced during defrost (see basic parameter F3)
- during the dripping and post-dripping phase (see advanced parameters dd and Fd) the fans are always off.

Note: with 'F0'=1, in normal control mode the fan temperature control uses the virtual probe Sv, even control is performed on Sr in night-time operation.

F1 Fan control temperature threshold (only if F0=1 or 2)

Code	UOM	Min	Max	Def.
F1	°C/°F	-50.0	50.0	-5.0

This represents the temperature threshold used to determine the activation of the fans in reference to the evaporator temperature and/or the virtual probe reading according to the table above. The value of F0 indicates:
- F0 = 1: Threshold for the difference between the evaporator temperature (Sd) and virtual probe temperature (Sv).
- F0 = 2: Absolute threshold for the evaporator temperature read by Sd.

Note:
- If there are two evaporator probes (see advanced section, Defrost – Second evaporator), control will be performed on the maximum value of the two probes available, to ensure that the fans are activated when all the probes reach the required temperature.
- In the event of errors on the control probes, the fans are always on.

F2 Enable stop fans with control off

Code	UOM	Min	Max	Def.
F2	Flag	0	1	1

In combination with parameter F0, this is used to link the status of the fans with the control status:

F2	Fan status	
0	F0=0	Fans always on
	F0=1,2	Fan controller active
1	Fans off if solenoid control off	

Tab. 5.v

F3 Stop fans during defrost

Code	UOM	Min	Max	Def.
F3	Flag	0	1	1

During the defrost, the operation of the fans can be selected as follows:
- F3 = 1: Fans on
- F3 = 2: Fans off

Fan differential (including variable speed)

Fd Post-dripping time after defrost

(fans off with control on)

Code	UOM	Min	Max	Def.
Fd	min	0	15	1

After the dripping phase, the fans may be stopped beyond the period dd for a further period Fd, to allow the evaporator to return to operating temperature ad avoid sending hot air into the refrigeration unit. This phase is called "post-dripping". Parameter Fd has priority over any other type of fan management in this period.

Frd Temperature control differential (including variable speed)

Code	UOM	Min	Max	Def.
Frd	°C/°F	0.1	20.0	2.0

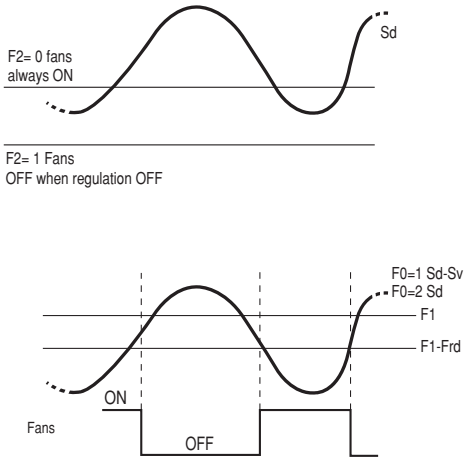


Fig. 5.f

A dd - Dripping time after defrsot (fans off), p. 54.

A Defrost on second evaporator, p. 54

ENGLISH

B H4 - Disable buzzer on terminal p. 39

A Double Thermostat, p. 42

This represents the temperature differential in relation to F1 for managing the activation of the fans. It is also used for the analogue control of the fan speed when phase control devices are adopted.
Fan operating status:

Function	F0	Sub-function	Parameters	ON	OFF
Fans without temperature control	0	Not linked to control status	F2=0	Always	Never
		Linked to control status	F2=1	Control ON	Control OFF
Fans controlled by evaporator temperature and virtual probe	1	-	Sv-Sd>F1 - Frd	Sv-Sd< F1	
Fans controlled by evaporator temperature	2	-	Sd < F1-Frd	Sd > F1	
Fan status in defrost	-	Select fan status during defrost	F3	F3=0	F3=1

Tab. 5.w

5.5 Temperature alarms

The high and low temperature alarms are used to display possible anomalies due to changes in the temperature inside the refrigeration unit. The activation of a temperature alarm involves:
- the activation of the buzzer (if enabled), see parameter H4
- a message shown on the display:
  - HI high temperature alarm
  - LO low temperature alarm

The temperature alarms have automatic reset, that is, the alarm is reset directly by the controller when the temperature returns within the allowed range.
Note: If the Double Thermostat function is enabled, the messages HI2 and LO2 are also displayed.
The parameters corresponding to the temperature alarms are used to:
- assign the measurement probe
- set the high and low temperature differential
- set the temperature thresholds
- set the activation delay

5.5.1 List of parameters

Code	Parameter
AA	Assign high and low temperature alarm probe
A0	Differential to reset high and low temperature alarms
A1	Select alarm thresholds relative to the set point or absolute
AL	Low temperature alarm threshold (outlet probe Sm in double thermostat)
AH	High temperature alarm threshold (outlet probe Sm in double thermostat)
Ad	high and low temperature alarm time

Tab. 5.x

5.5.2 Temperature alarm parameters

AA Assign high and low temperature alarm probe

Code	UOM	Min	Max	Def.
AA	-	1	10	1

This sets which physical probe is used to monitor the temperature and consequently signal any high or low temperature alarms.

AA	Probe
1	Control (Sreg, default)
2	Virtual (Sv)
3	Outlet (Sm)
4	Defrost (Sd)
5	Intake (Sr)
6	Evaporator outlet (superheated gas)*
7	Saturated evaporation*
8	Auxiliary defrost*
9	Auxiliary 1*
10	Auxiliary 2*

* see advanced parameters, General configuration – Assign probe functions

Tab. 5.y

A0 Differential to reset high and low temperature alarms

Code	UOM	Min	Max	Def.
A0	°C/°F	0.1	20.0	2.0

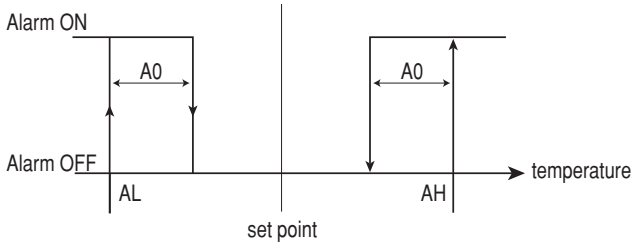


Fig. 5.e

This represents the differential used to deactivate the high and low temperature alarms. Specifically, it represents the hysteresis required for the automatic reset of both alarms, according to the diagram above.

A1 Select alarm thresholds relative to the set point or absolute

Code	UOM	Min	Max	Def.
A1	flag	0	1	0

Establishes the nature of the high and low temperature alarm thresholds:
- A1 = 0: Relative threshold
  The alarm thresholds are expressed as the difference from the current set point. Specifically
  SAH = St +AH
  SAL = St –AL
  Changing the set point also changes the thresholds.

1. A1 = 1: Absolute threshold
   The alarm thresholds are expressed as absolute values.
   SAH = AH
   SAL = AL

Changing the set point does not affect the thresholds.
Note: Parameter A1 also affects alarm thresholds AL2 and AH2, used in the "double thermostat" function.

A🛠 Double Thermostat, p. 42

AL Low temperature alarm threshold
(outlet probe Sm in double thermostat)

Code	UOM	Min	Max	Def.
AL	°C/°F	-50.0	50.0	4.0

Determines the activation threshold for the low temperature alarm. Its meaning depends on the value of the parameter A1
- A1 = 0
  AL is the relative threshold for the low temperature alarm, expressed as difference between the current set point and the value set for AL:
  SAL = St – AL
  In this case, the alarm is disabled if AL = 0.
  Changing the set point also changes the alarm thresholds by the same amount.
- A1 = 1
  AL is the absolute threshold for the low temperature alarm:
  SAL = AL
  The alarm is disabled if AL = -50°.

Changing the set point does not affect the thresholds.
The low temperature alarm features automatic reset, that is, if the temperature monitored falls below the threshold causing the activation of the alarm, it is automatically deactivated when the temperature rises back above the threshold, plus the differential A0.

AH High temperature alarm threshold
(outlet probe Sm in double thermostat)

Code	UOM	Min	Max	Def.
AH	°C/°F	-50.0	50.0	10.0

Determines the activation threshold for the high temperature alarm.
- A1 = 0
  AH is the relative threshold for the high temperature alarm, expressed as sum between the current set point and the value set for in AH:
  SAH = St + AH
  The alarm is disabled if AH = 0.
  Changing the set point also changes the alarm thresholds by the same amount.
- A1 = 1
  AH is the absolute threshold for the low temperature alarm:
  SAH = AH

The alarm is disabled if AH= 50°.
Changing the set point does not affect the thresholds.
The high temperature alarm also features automatic reset, that is, if the temperature monitored rises above the threshold causing the activation of the alarm, it is automatically deactivated when the temperature falls back below the threshold, minus the differential A0..

Ad Delay time for high and low temperature alarms

Code	UOM	Min	Max	Def.
Ad	min	0	240	120

This indicates after how many minutes from the moment the threshold is exceeded the temperature alarm is signalled. It helps avoid false alarms due to interference on the probe signal or temporary situations.
Note: The temperature alarm delay Ad interacts with the alarm bypass time after end defrost d8 and after continuous cycle c6. After these events, in fact, the temperature alarms are bypassed for the time set for the specific parameter. Only when the time d8 or c6 has elapsed does the delay Ad start counting.

B🛠 d8: Alarm bypass after defrost and door open, p. 30
A🛠 c6: Low temp. alarm bypass after "continuous cycle", p. 43

6. ADVANCED FUNCTIONS

Note:
To simplify understanding, the basic and advanced parameters are highlighted by references shown on the side of the page. For example, if the text refers to parameter A6, the following reference will be shown on the side of the page:

"A🛠 A6 p. 52"

MPXPRO features a vast range of advanced applications and functions that enhance the basic functions, introducing special and innovative management routines. As for the basic functions, the advanced applications can be divided into functional groups, based on their specific purpose.
The advanced functions are:

6.1 General configuration
6.2 Control
6.3 Electronic expansion valve
6.4 Compressor
6.5 Defrost
6.6 Fan speed modulation
6.7 Alarms
6.8 HACCP alarms

This chapter shows all the parameters corresponding to the advanced functions featured in the **MPX**PRO firmware. Based on the default configuration, the set of parameters used or the special settings entered by the user, these can be totally or partly masked and therefore not accessible to the final user.

6.1 General configuration

This section describes the advanced settings relating to:

6.1.2 Password
6.1.3 Analogue inputs
6.1.4 Probe functions
6.1.5 Network pressure/saturated temperature probe
6.1.6 Probe and saturated evaporation temperature calibration
6.1.7 LAN and HW
6.1.8 Virtual digital input

6.1.1 List of parameters

Code	Parameter
Password	
PS	Password for displaying configuration parameters
PSS	Password for entering the alarm log
PSU	Password for uploading the parameters
Analogue inputs	
/P1	Select type of probe, Group 1 (S1, S2, S3)
/P2	Select type of probe, Group 2 (S4, S5)
/P3	Select type of probe, Group 3 (S6)
/P4	Select type of probe, Group 4 (S7)
/P5	Select type of probe, Group 5 serial probes (S8 to S11)
/U6	Maximum value of sensor 6 (barg)
/L6	Minimum value of sensor 6 (barg)
/U7	Maximum value of sensor 7 (°C, °F or barg)
/L7	Maximum value of sensor 7 (°C, °F or barg)
Assign advanced probe functions	
/Fd	Assign evaporator outlet temp. probe (Tsuct EEV)
/FE	Assign saturated evaporation temp. probe (T/Psat EEV)
/FF	Assign defrost temperature probe 2 (Sd2)
/FG	Assignment of auxiliary temperature probe 1 (Saux 1)
/FH	Assignment of auxiliary temperature probe 2 (Saux 2)
Probe calibration	
/C1	Probe 1 calibration
/C2	Probe 2 calibration
/C3	Probe 3 calibration
/C4	Probe 4 calibration
/C5	Probe 5 calibration
/C6	Probe 6 calibration
/C7	Probe 7 calibration
Po5	Saturated evaporation temperature calibration
LAN and HW	
/5	Select °C or °F
/6	Disable decimal point
/t	Enable display alarms and messages on the secondary terminal
/t2	Select display on the secondary terminal
d6	Select display on terminal during defrost
H2	Disable keypad functions
H4	Disable buzzer on terminal
H6	Configure terminal keypad lock
Hdn	Number of sets of default parameters available
Virtual digital input	
A8	Configure function of virtual digital input
A9	Select digital input propagated from master to slaves

6.1.2 Password

MPXPRO features three types of password for accessing three different menus:

PS configuration parameters, PSS alarm log, PSU upload parameters

Code	UOM	Min	Max	Def.
PS	-	0	200	22
PSS	-	PS	200	PS+22
PSU	-	PS	200	PS+44

For further information, see chap. 7 "Programming key and Commissioning tool", p. 61.

The passwords can only be displayed on the user terminal, while they can be modified only from the supervisor, programming key and commissioning tool.

Note: The structure of the passwords requires only PS to be set, while the other values are determined automatically:

- PSS = PS +22
- PSU = PS + 44

6.1.3 Analogue inputs

MPXPRO features 7 configurable analogue/digital inputs (S1 to S7), up to 4 serial probes that can be set directly from the supervisory system, and the possibility of sharing the pressure probe connected to the master with all the units present in the master-slave LAN.

In particular, this paragraph explains all the settings required to modify the default configuration relating to the types of probes connected, plus the other information needed for correct operation.

For further information on the types of probes and the connections:
- diagrams and electrical connections, p. 12
- Temperature probe configuration, p. 21

/P1…/P4 Select type of probes, groups 1 to 4 (S1 to S7; DI1 to DI4)

The following table summarises the types of probes compatible with MPXPRO and the related parameters. It can be seen how the various inputs are divided into uniform groups, in which each input has the same features and can be configured by the same parameter.

group	probe physical	parameter	Types of probes							
			NTC	PTC	PT1000	NTC L243	0 to 5Vdc ratiometric	0 to 10 V dc input	4 to 20 mA input	DI
1	S1-S2-S3	/P1	/P1=0 default	/P1=1	/P1=2	/P1=3	-	-	-	-
2	S4/DI1 S5/DI2	/P2	/P2=0 default	/P2=1	/P2=2	/P2=3	-	-	-	DI1-DI2 /P2=0...3
3	S6/DI3	/P3	/P3=0 default	/P3=1	/P3=2	/P3=3	/P3=4	-	-	DI3 /P3=0...3
4	S7/DI4	/P4	/P4=0 default	/P4=1	/P4=2	/P4=3	/P4=4	/P4=5	/P4=6	DI4 /P4=0...3

Tab. 6.a

B🛠 /Fd: Post-dripping time after defrost, p. 37
B🛠 A4-A5-A10-A11-A12: Digital input configuration, p. 22

Analogue inputs S4 to S7 can also be used as digital inputs. In this case, simply configure the input as an NTC/PTC/Pt1000 temperature probe, and then suitably set parameters A4-A5-A10-A11-A12. In fact, groups 2, 3, 4 can be used in a mixed manner, that is, even if configured for NTC/PTC/PT1000 temperature probes, one of the probes can be used in this mode, while a digital input can be connected to the other input. In this case, the system can recognise the type of input connected. The only limitation is that the use of one type of probe is set, the others cannot be used.

Example 1 selecting the type of probes:
/P2=0: S4/DI1 and S5/DI2 standard NTC temperature probes
S4/DI1 can be used as the evaporator outlet temperature probe (/Fd=4)
S5/DI2 can be used as the remote ON/OFF digital input (A5=6)

Example 2 selecting the type of probes:
/P4=1 S7/DI4 standard PTC temperature probe
S7/DI5 can be used as a digital input for the immediate external alarm (A11=1)

/P5 Select type of probe, Group 5 serial probes (S8 to S11)

Code	UOM	Min	Max	Def.
/P5	-	0	15	0

Serial probes S8 to S11 are virtual probes that are not connected directly to the controller, and that receive the values directly from the supervisory system. This method can be used to share the value read by generic probes installed in the system between various units in different sub-networks. This function is especially useful for ensuing the regular operation of the unit in the event of probe malfunctions. The type of probe is assigned by each individual bit, see diagram below.

- bit = 0 Temperature probe
- bit = 1 Generic probe

The difference between these configurations lies in the way that **MPX**PRO interprets the value send by the supervisor:

- bit = 0 Temperature probe: the value is read by the controller as a temperature probe and interpreted according to the unit of measure (°C or °F) set for parameter /5. In this mode, the supervisory system must send the value of the variable according to the setting of /5. The various recording, calculation or display operations are performed by **MPX**PRO in accordance with the unit of measure specified.
- bit = 1 Generic probe: the value is read and treated as a generic probe. No conversion of the units is allowed during the operations, and no unit of measure is defined.

Default: The default settings define all the serial probes as temperature probes.
The system interprets the value of the serial probes based on the bitwise configuration of parameter /P5.

A🛠 /5 Select °C or °F, p. 38

Specifically, considering the binary representation of the value of the parameter, the four bits on the right represent the configuration of the four probes, according to the following diagram:

bit number	*	*	*	*	3	2	1	0
decimal value	*	*	*	*	8	4	2	1
serial probe	*	*	*	*	S11	S10	S9	S8

The type of probe can be configured based on the value of the individual bits

• **Example 1:**

S8 = temperature probe ⟹ bit 0 = 0
S9 = generic probe ⟹ bit 1 = 1
S10 = generic probe ⟹ bit 2 = 1
S11 = temperature probe ⟹ bit 3 = 0

bit	3	2	1	0	
Bit value	0	1	1	0	
Corresponding decimal value	8	4	2	1	
Partial value	0 +	4 +	2 +	0	/P5 = 6

Note: The other bits (4 to 8) are ignored and considered null, as they have no meaning

• **Example 2:**

S8 = temperature probe ⟹ bit 0 = 0
S9 = temperature probe ⟹ bit 1 = 0
S10 = generic probe ⟹ bit 2 = 1
S11 = generic probe ⟹ bit 3 = 1

bit	3	2	1	0	
Bit value	1	1	0	0	
Corresponding decimal value	8	4	2	1	
Partial value	8 +	4 +	0 +	0	/P5= 12

• **Example 3:**

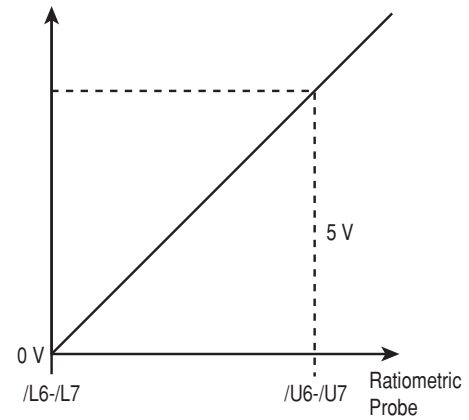
To set S8-S9 as non-temperature probes (generic) and S10 - S11 as temperature probes, set /P5 = 1+2=3

/U6 /L6 /U7 /L7 Minimum and maximum values of probes S6 and S7

As well as the common NTC, PTC and PT1000 probes, **MPX**PRO can connect the following to inputs S6 and S7:

- 0 to 5 Vdc ratiometric probes (powered directly by the controller)
- Active 4 to 20 mA probes (not powered by the controller)
- Active 0 to 10 Vdc probes

This type of probes require the definition of the range of measurement, that is, the maximum and minimum values that can be measured. Parameters /L6, /L7, /U6 and /U7 are used especially for this purpose, for probes S6 and S7 respectively.



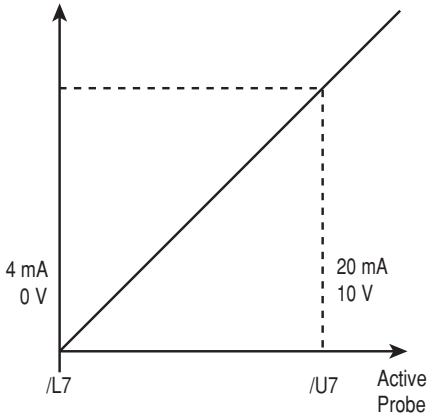


Fig. 6.a

/U6 Maximum value of sensor 6 (barg)

Code	UOM	Min	Max	Def.
/U6	barg	/L6	100.0	9.3

This represents the maximum value that the ratiometric sensor connected to analogue input S6 can measure. It determines the maximum possible value associated with an input of 5V.

/L6 Minimum value of sensor (barg)

Code	UOM	Min	Max	Def.
/L6	barg	-100.0	/U6	-1.0

This represents the minimum value that the ratiometric sensor connected to analogue input S6 can measure. It determines the minimum possible value associated with an input of 0V.

/U7 Maximum value of sensor 7 (barg)

Code	UOM	Min	Max	Def.
/U7	barg	/L7	100.0	9.3

This represents the maximum value that the analogue input S7 can measure. It determines the maximum possible value associated with an input of 5V, 20mA or 10V, based on the type of probe connected.

/L7 Minimum value of sensor 7 (barg)

Code	UOM	Min	Max	Def.
/L7	barg	-100.0	/U7	-1.0

This represents the minimum value that the analogue input S7 can measure, associated with an input of 0V or 4mA, based on the type of probe connected.

Example: Connecting a ratiometric probe to input S6

To connect a ratiometric probe (0 to 5V) to physical input S6, and ensure that the values measured are correctly displayed by the controller, par. /P3/U6/L6/FE must be set as follows:

Parameter	Action
/P3 = 4	Ratiometric probe (0 to 5 Vdc) to input S6
/U6 = 9.3	The maximum value displayed by the controller is 9.3 bar.
/L6 = -1	The minimum value displayed by the controller is -1 bar.
/FE = 6	Pressure sensor to measure the saturated evaporation temperature

Tab. 6.b

MPXPRO automatically converts the pressure value measured by the physical probe to the saturated evaporation temperature, based on the type of refrigerant indicated for parameter PH.

B🛠 /FA, /Fb, /Fc: Assign temperature probes, p. 21
A🛠 PH: EEV Main type of refrigerant – p. 45

6.1.4 Assign probe functions

Chapter 5 (basic functions) describes three main functions relating to the temperature probes for the control of the refrigeration unit:

- air outlet temperature: Sm, parameter /FA;
- defrost temperature: Sd, parameter /Fb;
- air intake temperature: Sr, parameter /Fc

As well as these, **MPX**PRO features other special functions directly associated with any physical probe connected to the controller or one of the serial probes available, for managing the electronic valve or other advanced functions.

Assignment of the advanced probe functions

cd	Name	UOM	Min	Max	Def.
/Fd	Assign evaporator outlet temp. probe (Tsuct EEV))	-	0	11	0
/FE	Assign saturated evaporation temp. probe (T/Psat EEV)	-	0	11	0
/FF	Assign defrost temperature probe 2 (Sd2)	-	0	11	0
/FG	Assign auxiliary temperature probe 1 (Saux 1)	-	0	11	0
/FH	Assign auxiliary temperature probe 2 (Saux 2)	-	0	11	0

Each function can be associated with any probe:

/Fd /FE /FF /FG /FH	Associated probe
0	disabled
1	S1
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8 serial
9	S9 serial
10	S10 serial
11	S11 serial

6.1.5 Network pressure / saturated evaporation temperature probe

MPXPRO ccan share the pressure/saturated temperature probe on the master within a master-slave network. This mode is automatic, no parameter needs to be set. If any of the slaves controls an electronic valve, it requires a pressure probe. If this is available locally, that is, connected directly to the slave, this probe has absolute priority and the device uses it to control the valve. If no probe is fitted or there is a probe error, the slave automatically requests the pressure value from the master and uses that probe for the control functions. Only when the pressure probe on the master also shows an error does the slave activate the emergency function to bypass the probe with parameter P15.

Note:

- the local probe has priority over the network probe
- the calibration of the saturated temperature (Po5) is performed locally on each device
- the calibration of the probe (c1 to c7) is performed by the device that the probes are connected to

Example. Below is a possible configuration of the physical probes on a refrigerated cabinet for the management of the electronic valve

physical probe	Type of probe	Parameter	Function assigned	Parameter
S1	Standard NTC	/P1=0	Outlet temp.	/FA=1
S2			Defrost temp.	/Fb=2
S3			Intake temp.	/Fc=3
S4	Standard NTC	/P2=0	Intake temp.	/Fd=4
S5	Digital input		Day-night	A5=7
S6	0 to 5 V ratiometric	/P3=4	Evaporation pressure	/FE=6

Tab. 6.c

A🛠 P15: EEV - Main Support saturated temp. in the event of pressure probe error, p. 47
A🛠 c1...c7: Calibration S1...S7, p. 38
A🛠 Po5: Saturated evaporation temperature probe calibration, p. 38

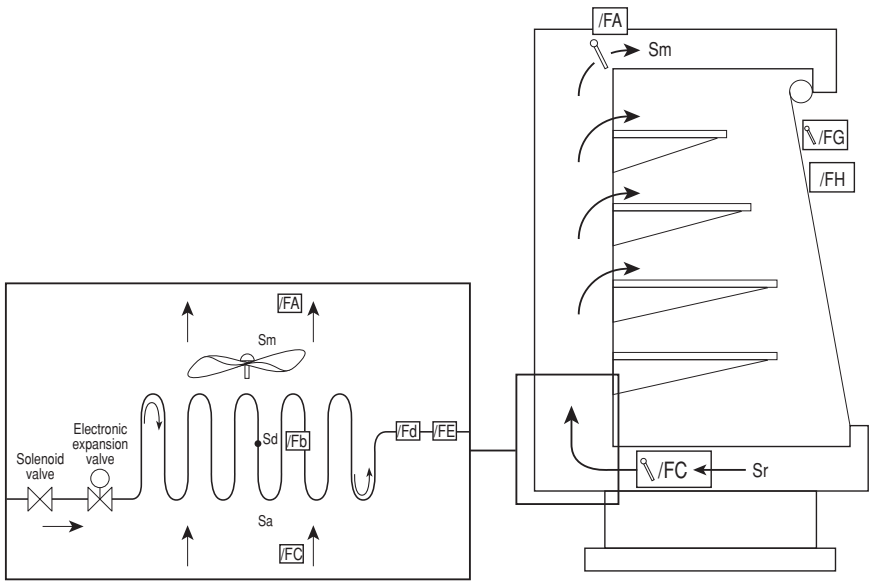


Fig. 6.b

/C1 to /C7

Parameter	Probe
/C1	S1
/C2	S2
/C3	S3
/C4	S4
/C5	S5
/C6	S6
/C7	S7

Important:
- The calibration parameters are only active for probes set for temperature measurements.
- If the probe is not suitably configured, the calibration parameters show the message "___";
- If there is a probe error, the display shows the specific error message for the probe.

6.1.6 Probe and saturated evaporation temperature calibration

MPXPRO can adjust the values read by the probes and some of the internal variables. In particular, /c1 to /c7 are used to increase or decrease the values read by the physical probes if configured as temperature probes. Parameter Po5, on the other hand, corrects the value of the saturated evaporation temperature calculated directly based on the evaporation pressure. The serial probes cannot be calibrated, while the probes shared with the master are calibrated by the master.

/c1…/c7 Calibration of probes S1 to S7 (cannot be uploaded)

Code	UOM.	Min	Max	Def.
/c1…/c7	°C/°F or barg	-20.0	20.0	0.0

These correct the reading made by probes S1 to S7 respectively (see the table to the side), so that **MPX**PRO considers the value read increased or decreased by the set value as the effective value.
The table to the side shows the association between parameter-calibrated probe (the virtual sensors S8 to S11 do not require calibration). Calibration is performed before checking if the value if out-of-range, that is, **MPX**PRO first determines the values read by the probes, correcting them based on the calibration parameters, then checks if these are outside of the range specified and where necessary generates a probe error.
Example: To decrease the temperature measured by sensor S1 by 3 °C, set /c1 = -3.

Po5 Saturated evaporation temperature calibration

Code	UOM	Min	Max	Def.
Po5	°C/°F	-20.0	20.0	0.0

To calibrate the value of the saturated evaporation temperature, enter the offset value for this parameter. The action of this parameter is similar to the ones described above.

6.1.7 LAN and Hardware

Below are the parameters corresponding to the advanced configuration of the local communication network (LAN), the hardware features and navigation.

/5 Select °C or °F

Code	UOM	Min	Max	Def.
/5	flag	0	1	0

Defines the unit of measure used for control and display
- /5 = 0: degrees centigrade (°C)
- /5 = 1: degrees Fahrenheit (°F)

/6 Disable decimal point

Code	UOM	Min	Max	Def.
/6	flag	0	1	0

This is used to enable or disable the temperature display with resolution to the tenth of a degree between –20.0 and +20.0. Outside of this range the resolution is always unvaried (°C/°F)
- /6 = 0: data displayed with resolution to the tenth of a degree
- /6 = 1: data displayed without resolution to the tenth of a degree

/t Enable display alarms and messages on secondary terminal

Code	UOM	Min	Max	Def.
/t	flag	0	1	0

This is used to enable or disable the display of the alarm codes on the secondary display)
- /t = 0: alarms not displayed
- /t = 1: alarms and messages displayed

/t2 Select display on secondary terminal

Code	UOM	Min	Max	Def.
/t2	flag	0	14	0

This is used to select the probe displayed on the secondary terminal (display)

/t2	Associated probe
0	Absent (*) (default)
1	S1
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8 - serial
9	S9 - serial
10	S10 - serial
11	S11 - serial
12	Control probe (Sreg)
13	Virtual probe (Sv)
14	Set point

(*) No probe is displayed / Display not installed

d6 Select display on terminal during the defrost

Code	UOM	Min	Max	Def.
d6	-	0	2	1

During defrost, different types of messages can be shown on the user terminal and on the display:
- d6 = 0: the message "dEF" is displayed, alternating with the value read by the selected probe;
- d6 = 1: the last temperature measured before the defrost remains displayed. Based on the type of defrost, the normal display resumes when reaching the end defrost set point, when the temperature to be displayed is lower than the temperature currently frozen on the display, or in any case after the end of the alarm bypass period after defrosting (basic parameter d8);
- d6 = 2: message dEF fixed on the terminal/display.

Note: When /t = 0 the defrost messages are also disabled on the display

N.B.: The unit remains in defrost status until the end of the post-dripping phase, and consequently the display reflects this until the end of this phase.

B🛠 /t1: Select display terminal, p. 22
A🛠 /t: Display alarms on second display, p. 38
A🛠 /t2: : Enable second display, p. 38

B🛠 d8: Alarm bypass after defrost and door open, p. 30

H2 Disable keypad functions

Code	UOM	Min	Max	Def.
H2		0	5	1

H2 can be set to deactivate access to some functions from the keypad. The individual buttons are in any case active for displaying the values, but only the functions are disabled, according to the table below.

H2	Functions disabled
H2 = 0	set F parameters modify set point
H2 = 1	-
H2 = 2	set F parameters modify set point settings from the remote control (future release)
H2 = 3	-
H2 = 4	UP - continuous cycle DOWN - defrost set F parameters
H2 = 5	UP - continuous cycle DOWN - defrost set F parameters modify set point

For further information, see Chap. 3 "User interface", p. 16

H4 Disable buzzer on terminal

Code	UOM	Min	Max	Def.
H4	flag	0	1	0

- H4 = 0: buzzer enabled
- H4 = 1: buzzer disabled

H6 Configure terminal keypad lock

Code	UOM	Min	Max	Def.
H6	-	0	15	0

This is used to disable/enable the individual buttons. Unlike parameter H2, the value of H6 can deactivate all the functions accessible or modifiable using the specific button or a combination of buttons. The buttons disabled depend on the binary representation of the value entered for the parameter, with the individual button being activated/deactivated based on the value of an individual bit.

A🛠 H2: Disable keypad functions, p. 39

- bit = 0 button enabled
- bit = 1 button disabled

For further information, see Chap. 3 "User interface", p. 16

bit number	*	*	*	*	3	2	1	0
decimal value	*	*	*	*	8	4	2	1
button disabled	*	*	*	*	PRG	UP	DOWN	SET

Disabling a button also disables all the functions accessible and/or modifiable using that button, according to the following table

Value	Button	Functions disabled
H6 = 0	-	no function disabled
H6 = 1	SET	Enter HACCP Access set point Display and set parameters Multiplexed defrost Copy parameters from master to slave Select the network unit from shared terminal Access alarm log
H6 = 2	DOWN	Limited navigation and modifications Local and multiplexed defrost Select the network unit from shared terminal HACCP continuous cycle
H6 = 4	UP	Limited navigation and modifications Activate/deactivate auxiliary output Continuous cycle Reset alarms
H6 = 8	PRG	Mute buzzer Access parameters Copy parameters from master to slave Select the network unit from shared terminal Reset default parametersAccess alarm log Reset HACCP alarms

As well as the simple values, described in the table, all the intermediate combinations are also possible, allowing more than one button to be disabled at the same time.

Example: To disable UP and PRG set the corresponding bits to 1 (bit2 and bit3) and therefore, according to the previous table, set H6=4+8=12. This will disable all the functions that can be activated or modified

by at least one of the two buttons.

Hdn Number of sets of default parameters available (display only)

Code	UOM	Min	Max	Def.
Hdn	-	0	2	0

Important: display only

MPXPRO, as well as the standard configuration, may feature a different set of parameters that can be loaded. The set identified as 0 represents the set of parameters used by the instrument. The additional sets 1 and 2 are different support sets saved in the memory that can be loaded when starting the instrument. The different sets identify typical groups of parameters different for applications.

Hdn	Note
0	Only the current set of parameters is available. The levels of visibility cannot be modified, and only the visible parameters can be set.
1,2	Sets of parameters other than the current set are available. The programming key or commissioning tool can be used to set the visibility attributes and upload the values of all the parameters

The procedure for restoring the default parameters only acts on set 0. The value of Hdn must be identical in all the sets loaded on the controller.

6.1.8 Virtual digital input (configuration of the virtual digital input for activation of the curtain switch

MPXPRO can propagate the status of a digital input across the master/slave sub-network.
This input is called the virtual digital input. Its status may derive:
- from a digital input directly connected to the master
- from the supervisory system

On every controller in the sub-network, this input can be used to activate any function of a generic digital input, including functions that are different from the others on the others instruments. The slave unit is not concerned with the actual origin of the status received. The master unit determines the origin by parameter A9. To configure the curtain switch, and consequently the changeover from day to night status in the entire local network by propagation of the virtual digital input, the digital input that determines the changeover can be connected to the master, setting the following parameters:

Unit	Parameter	Action
master	A9 = 1	Enable propagation of DI1
master	A8 = 7*	DI1 master = curtain switch
slave	A8 = 7	On the Slaves, virtual digital input = curtain switch

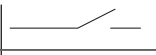
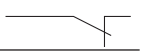
In this way, each slave changes from day status to night status or vice-versa whenever the status of digital input DI1 on the master changes. To see the effect of this function, refer to the description of the function of the digital inputs (basic parameters A4 to A12).
* DI1 has been selected to be propagated as the virtual digital input, while its function is configured by parameter A8, as on the slave units.

B A4, A5, A10, A11, A12: Digital input configuration, p. 22

A8 Configure function of virtual digital input

Code	UOM	Min	Max	Def.
A8	-	0	7	0

This determines the function associated with the virtual digital input; the functions that can be associated are exactly the same as for a normal digital input physically connected to the unit. On the master, configured to propagate the status of a physical digital input (A9≠0) as the virtual digital input, the setting of A8 has priority over any configuration set for parameters A4 to A12.

A8	Function		
0 (default)	Input not used	-	-
1	Immediate external alarm	Active	Inactive
2	Delayed external alarm / display only	Active	Inactive
3	Enable defrost	Not enabled	Enabled
4	Defrost call	Not active	Active
5	Door switch	Door open	Door closed
6	Remote ON/OFF	OFF	ON

For further information, see the configuration of the digital inputs (parameters A4 to A12).
The virtual digital input is useful for controlling coordinated functions within the LAN, and saves on wiring costs. If needed, different functions can be configured on the different slaves, meaning the change in status of the contact on the master determines the activation of different functions on the various slaves.

A9 Select digital input propagated from master to slaves

Code	UOM	Min	Max	Def.
A9	-	0	5	0

A9	DI paragraph
0	from the supervisor
1	DI 1
2	DI 2
3	DI 3
4	DI 4
5	DI 5

This can be configured only on the master unit, enabling the propagation via tLAN of the status of one of the digital inputs on the master or sent by the supervisor to the slaves. Based on the value associated with the parameter, **MPX**PRO propagates only one of the digital contacts across the LAN, according to the table on the side. The slaves receive the status of the virtual digital input and activate the corresponding function, according to the specific parameter A8.

6.2 Control

This section describes the parameters corresponding to the advanced control functions:

6.2.2Settings

6.2.3 Special functions

6.2.1 List of parameters

Code	Parameter
Settings	
r1	Minimum set point
r2	Maximum set point
/2	Analogue probe measurement stability
ro	Control offset in the event of probe error
Special functions	
St2	Intake probe set point with double thermostat
rd2	Control differential with double thermostat
c4	ON time for duty setting operation (Toff= 15 min fixed)
cc	Duration of continuous cycle operation
c6	Low temperature alarm bypass time after continuous cycle

6.2.2 Settings

This paragraph describes the advanced functions for configuring the set point and the temperature measurement functions on a refrigeration unit, in particular relating to:
The range of the set point
The frequency for refreshing the control probe reading
Operation in the event of control probe breakage

r1 Minimum set point

Code	UOM	Min	Max	Def.
r1	°C/°F	-50.0	r2	-50.0

This is used to set the minimum temperature set point value that can be set by the user. The set point cannot be set below this limit.

r2 Maximum set point

Code	UOM	Min	Max	Def.
r2	°C/°F	r1	50.0	50.0

This is used to set the maximum temperature set point value that can be set by the user. The set point cannot be set above this such limit.

/2 Analogue probe measurement stability

Code	UOM	Min	Max	Def.
/2	-	1	15	4

This determines the refresh rate for the values read by the probes.

- **Low values** mean very frequent readings, and consequently allow higher sensitivity of the control in response to rapid variations in the values measured. This may also mean greater sensitivity to disturbance.
- **High values,** on the other hand, mean a lower frequency and consequently greater stability of the measurement, together with greater immunity to disturbance.

Measurement update sequence:

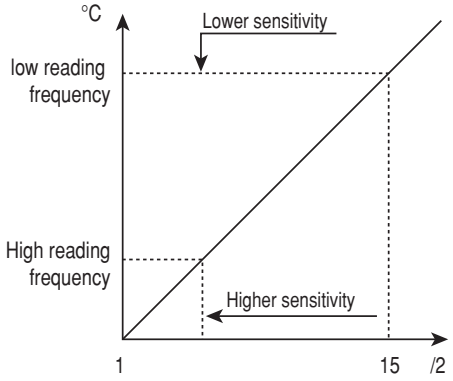


Fig. 6.c

ro Control offset in the event of probe error

Code	UOM	Min	Max	Def.
ro	°C/°F	0.0	20.0	0.0

In the standard mode, **MPX**PRO uses the virtual probe Sv as the control probe (see basic parameter /4). In the event of errors or breakage of one of the two probes making up the virtual probe (outlet or intake probe), parameter ro is used to continue normal operation in controlled conditions, without requiring immediate service by maintenance personnel. The recommended value of ro is the difference between the outlet probe and intake probe temperature readings in stable operation of the refrigeration unit..

$$ro \approx Sr - Sm$$

If ro=0 the function is not active.
In the event of an error on the outlet probe Sm, **MPX**PRO starts control based solely on the intake probe Sr, considering a new set point (St*), determined by the following formula.

$$St^* = St + ro \cdot \frac{100 - /4}{100}$$

If the error is on the intake probe Sr, on the other hand, control is performed solely on probe Sm, considering the new set point (St*)

$$St^* = St - ro \cdot \frac{/4}{100}$$

This function remains active until the errors have been resolved.
If, on the other hand, both temperature probes are faulty, duty setting mode is activated (see advanced parameter c4). In night status, when suitably configured, **MPX**PRO may use the intake probe Sr only for control. If there is an error with this probe, and the outlet probe is fitted, the unit responds as if /4=100

B /4: Virtual probe composition (Sv), p. 28

A c4: ON time in duty setting operation, p. 43

Examples of using parameter 'ro':

Examples of using 'ro' in the event of a probe fault	New probe	Control probe	Set point	ro=(Sr-Sm)	New set point
E.g. 1 Sm fault in daytime operation	Sr	Sv /4=0 100% Sm	St=-2	5 = +2-(-3)	=St+ro*(100-/4)/100 =-2+5*(100-0)/100 =3
E.g. 2 Sr fault in daytime operation	Sm	Sv /4=75 75% Sm	St=-1	5=+2-(-3)	=St-ro*(100-/4)/100 =-1-5*(100-75)/100 = -2.25

Tab. 6.d

6.2.3 Special functions

This paragraph describes the following advanced control functions on **MPX**PRO:

6.2.3.1 Double Thermostat
6.2.3.2 Duty Setting
6.2.3.3 Continuous cycle

6.2.3.1 Double Thermostat

Double Thermostat is a special function on **MPX**PRO that is used to control the temperature inside a refrigeration unit using two separate thermostats, one associated with the outlet probe and the other with the intake probe. This control technique is used to appropriately manage the day-night changeover, and in particular the closing of the curtain at night, without requiring any external contact. The lowering of the curtain in fact generally causes a decrease in the temperature inside the unit, and may cause problems if the control method is not adapted.

The two thermostats each have their own specific set point (St for the outlet probe, St2 for the intake probe) and corresponding differential (rd for Sm, rd2 for Sr.

Probe	set point	Differential
outlet 'Sm'	'St'	'Rd'
intake 'Sr'	'St2'	'Rd2'

The operation of each thermostat (Sm or Sr) is perfectly identical to the operation described for the main control probe.

The general control status depends on the combination of the status of both thermostats, that is, control will be active only when both thermostats require refrigeration. The table below illustrates the general status of the unit based on the status of the two thermostats.

Outlet probe Sm	Intake probe Sr	Thermostat
call	call	ON
satisfied	call	OFF
call	satisfied	OFF
satisfied	satisfied	OFF
error or absent (equivalent to call)	call	ON
error or absent (equivalent to call)	satisfied	OFF
call	error or absent (equivalent to call)	ON
satisfied	error or absent (equivalent to call)	OFF
error or absent	error or absent	duty setting 'c4'

Tab. 6.e

Note:

- Parameter 'rd2'>0 enables the double thermostat function.
- In double thermostat operating mode, there is no recovery from outlet and intake probe errors using parameter 'ro'.
- In double thermostat operating mode, there is no change in the set point in night-time operation, with reference to parameter 'r4'.

Below are the values of parameters St2 (intake probe set point Sr) and rd2 (intake probe set point differential) required to activate the double thermostat function.

St2 Intake probe set point with 'double thermostat'

Code	UOM	Min	Max	Def.
St2	°C/°F	r1	r2	50.0

In the Double Thermostat function, this indicates the value of the set point in relation to the intake probe (Sr).

rd2 Control differential with 'double thermostat'

Code	UOM	Min	Max	Def.
rd2	°C/°F	0.0	20.0	0.0

This represents the differential for the intake probe Sr in mode Double Thermostat mode.
rd2=0 the 'double thermostat' function is disabled.

6.2.3.2 Duty Setting

Duty Setting is a special function used to maintain control in emergency situations with errors in the temperature control probes. The controller, in fact, even with just one temperature control probe operating (outlet or intake), attempts to adapt its operating characteristics to the special conditions (see parameter ro). If neither of the two is available, the "Duty Setting" control starts. With this function, the controller is activated at regular intervals, operating for a time equal to the value set for the duty setting parameter (c4) and off for a fixed time of 15 minutes. This mode manages to temporarily extend service times.

B St, rd: Unit set point - temperature differential, p. 27

see paragraph 5.2 "Basic control", p. 27

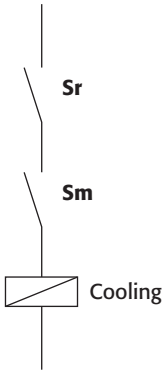


Fig. 6.d

B r4: Automatic night-time set point variation, p. 28

A ro: Control offset with probe error, p. 28

c4 ON time for duty setting operation (tOFF= 15 min fixed)

Code	UOM	Min	Max	Def.
c4	min	0	100	0

IIn the event of alarms on the components of the control probes, c4 allows the controller to be operated awaiting the resolution of the fault. As the controller cannot adapt operation based on the temperature inside the refrigeration unit, it operates for a time equal to c4 (ON time) and stops for a fixed time of 15 min (OFF time). The ON time may last from 0 to 100 minutes:
1. c4=0 control always on
2. c4=100 control always off

With the duty setting active, during the ON time the icon remains on, while flashes during the off status. The table below describes the possible error situations on the components of the control probe in various types of systems (with one or two probes).

Examples of systems	Control probe fault		Action of **MPX**PRO	Parameter
	Sm	Sr		
System with just one probe	✔		Duty setting	c4
		✔	Duty setting	c4
System with two probes	✔		Control with Sr	ro(*)
		✔	Control with Sm	ro(*)
	✔	✔	Duty setting	c4

Tab. 6.f

(*) in **MPX**PRO the changeover to the other probe in the event of faults is automatic if ro > 0.
Note: In duty setting mode, the compressor times are ignored.

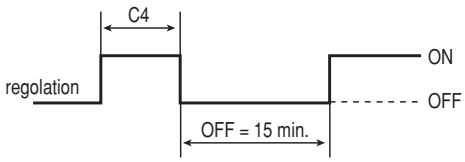


Fig. 6.e

A🛠 ro: Control offset in the event of probe error, p. 41

6.2.3.3 Continuous cycle

IThe continuous cycle is a special function on MPXPRO that is used to keep the refrigeration cycle active continuously for a settable duration, irrespective of the temperature inside the unit. This may be useful when requiring a rapid decrease in the temperature, including below the set point.
The continuous cycle is activated by pressing the UP & DOWN buttons more than 5 seconds, or from the supervisor.

The continuous cycle cannot be activated if:
- the duration of the continuous cycle is set to 0 (cc=0);
- the control temperature is less than the low temperature threshold AL (AL2 in double thermostat);
- the device is OFF.

When the continuous cycle is running:
- the solenoid output and valve control are activated, and the icon is shown on the display;
- the low temperature alarm AL (AL2 in double thermostat) is active;

Note: Opening the door (digital input) stops the cycle. When closing the door again, system resumes from the previous status.
The continuous cycle remains in standby if:
- the compressor protection times are set (c1, c2, c3);
- the immediate or delayed alarm from external digital input delays the activation of the compressor;
- defrost, dripping, post-dripping are active;
- the door is open (in the same way as described previously).

The continuous cycle ends when:
- pressing the UP & DOWN buttons for more than 5 seconds;
- supervisor;
- the low temperature threshold is reached (AL or AL2 in double thermostat);
- end of the continuous cycle duration cc;
- controller switched off from the supervisor (logical OFF).

B🛠 AL: Low temp. alarm threshold, p. 33
A🛠 AL2: Low temp. alarm threshold on intake probe Sr, p. 58

cc "Continuous cycle" operation duration

Code	UOM	Min	Max	Def.
cc	ore	0	15	1

This determines the compressor operating time in continuous cycle. During the time set for cc, the compressor will continue operating so as to rapidly decrease the temperature (including below the set point).
cc=0 Continuous cycle deactivated

c6 Low temperature alarm bypass time after "continuous cycle"

Code	UOM	Min	Max	Def.
c6	min	0	240	60

This determines the time in minutes during which the temperature alarm is disabled after the continuous cycle. If the temperature in the refrigerated unit, at the end of the continuous cycle, falls below the threshold AL (or AL2 in double thermostat), c6 delays the temperature alarm for the time set for the parameter.
When c6 elapses, any temperature alarms are only activated after Ad

B🛠 Ad: Delay time for high and low temperature alarms, p. 33

6.3 Electronic expansion valve

This section describes the electronic expansion valve and the settings for correct operation.

6.3.1 Introduction
6.3.2 List of parameters
6.3.3 Generic functions
6.3.4 Control
6.3.5 Safety functions and alarms
- LSH
- MOP
- LSA
- LOP

6.3.6 Manual valve positioning from the supervisor
6.3.7 Read-only status variables
6.3.8 Power failure

6.3.1 Introduction

MPXPRO, depending on the optional boards installed, can manage different types of electronic expansion valve. Specifically:

Option	Option code	Model of valve
Stepper	MX2OPSTP**	CAREL E²V
PWM	MX2OPPWM**	PWM 115 – 230 Vac
		PWM 110 – 210 Vdc

To manage the electronic expansion valve, two additional probes must be installed and suitably configured:

- Temperature probe for measuring the superheated gas temperature at the evaporator outlet.
- Pressure probe for the measurement of the pressure / saturated evaporation temperature at the evaporator outlet.

In addition, if the optional Stepper board is used (MX2OPSTP**), an external 230/24 Vac 20VA transformer is required and, optionally, a backup battery in the event of power failures. Recommended CAREL codes:

TRADRBE240	20 VA transformer, DIN rail
TRA00BE240	20 VA transformer, panel
EVBAT00300	Optional battery kit

Important:
For further information regarding assembly and the connections, see paragraph 2.2 "Wiring diagram and board connections", p. 12

Installation notes

MPXPRO is designed to manage one electronic expansion valve that controls the flow of refrigerant inside an individual evaporator. Two evaporators in parallel cannot be managed with just one electronic expansion valve.

• The NTC/PTC/PT1000 temperature probe must be installed near the evaporator outlet, according to the standard installation methods (see the installation notes on the E2V instruction sheet). Suitable thermal insulation is recommended. CAREL offers special types of probes designed to simplify installation in contact with the refrigerant pipe:

NTC030HF01 for Retail use IP67, 3m, -50T90 °C, 10 pcs
NTC060HF01 for Retail use IP67, 3m, -50T90 °C, 10 pcs

A🛠 /FE: Assign advanced probe functions, p. 37

- To measure the saturated evaporation temperature, different types of probes can be used; in particular, the following can be configured (advanced parameter /FE:

0 to 5 V ratiometric pressure probe
NTC/PTC/PT1000 temperature probe
Active 4 to 20 mA pressure probes (powered externally)

CAREL recommends the use of the following ratiometric probes

SPKT0053R0 0 to 5Vdc, -1 to 4.2 bar, for LT circuits
SPKT0013R0 0 to 5Vdc, -1 to 9.3 bar, for MT circuits

NB: **MPX**PRO can measure the saturated evaporation temperature using a normal NTC/PTC/PT1000 temperature probe (see price list). This solution, even if economically convenient, requires careful installation and in any case does not offer the same precision as a ratiometric probe. CAREL recommends the use of ratiometric probes for reading the evaporation pressure, which is automatically converted to the saturated temperature using the specific tables for the type of refrigerant used.

A🛠 P3: EEV - PID superheat set point, p. 45

Description of operation

The values read by the probes described above are called:

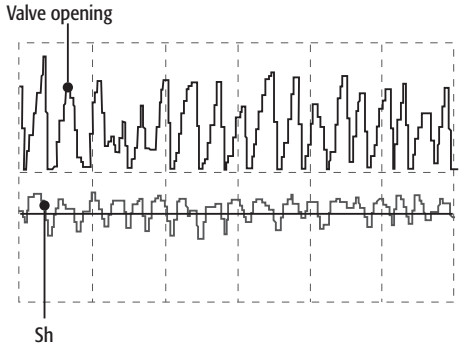
- T_{SUCT} =evaporator outlet temperature
- T_{SAT}=saturated evaporation temperature converted from pressure.

These values are used to calculate the superheat:

$SH = T_{SUCT} - T_{SAT}$

MPXPRO manages the proportional opening of the electronic expansion valve, adjusting the flow of refrigerant in the evaporator, so as to maintain the superheat around the value set for advanced parameter P3 (superheat set point).

The opening of the valve is controlled simultaneously yet independently from normal temperature control. When there is a refrigeration call (the compressor / solenoid valve relay is activated), control of the electronic valve is also activated and then managed independently. If the superheat value read by the probes is greater than the set point, the valve is opened proportionally to the difference between the values (see the figure on the side). The speed of variation and the percentage of opening depend on the set parameters.



SH Vs Valve opening

Fig. 6.f

The opening is continuously modulated based on the superheat value, with PID control. **Note:** All the references relating to control of the electronic valve are based on the use of a CAREL E2V electronic expansion valve. The descriptions are then made considering the steps of the stepper motor used for this type of valve, for example, the maximum number of opening steps is 480. All the functions are also then described for PWM valves.
In particular, instead of the maximum opening expressed as the number of steps, the maximum ON/OFF time of the PWM valve is considered (default 6 seconds). The absolute openings expressed as steps must then be suitably converted by the user and referred to the maximum fixed period, expressed in seconds.

6.3.2 List of parameters

Code	Parameter
Generic functions	
PH	EEV – Main Type of refrigerant
P1	EEV – Main Select model of electronic valve
P3	EEV – PID superheat set point
cP1	EEV – ADV Initial valve position when control starts
Pdd	EEV – ADV Initial valve position maintenance time after defrost
PSb	EEV – ADV Valve standby position
Phr	EEV – ADV Enable fast update of the valve parameters to supervisor
OSH	EEV – ADV Superheat Offset for modulating thermostat
P15	EEV – Main Support saturated temp. in the event of pressure probe error
PID control	
P4	EEV – PID Proportional gain
P5	EEV – PID Integration time
P6	EEV – PID Derivative time
Safety functions and alarms LSH – Low superheat	
P7	EEV – LSH Low superheat threshold
P8	EEV – LSH Low superheat integration time
P9	EEV – LSH Low superheat alarm delay
MOP – Maximum evaporation pressure	
PM1	EEV – MOP MOP threshold (saturated evaporation temperature)
PM2	EEV – MOP MOP integration time
PM3	EEV – MOP MOP alarm delay
PM4	EEV – MOP MOP function delay when starting control
PM5	EEV – MOP Enable close solenoid local valve for MOP alarm
LSA – Low evaporator outlet temperature alarm	
P10	EEV – MAIN Enable close solenoid valve for low superheat LSH and/or low suction temperature LSA
P11	EEV – LSA Low suction temperature threshold
P12	EEV – LSA Low suction temperature alarm delay
P13	EEV – LSA Low suction temperature alarm differential (°C)
P15	EEV – Main Support saturated temp. in the event of pressure probe error
LOP – Minimum evaporation pressure	
PL1	EEV – LOP LOP threshold (saturated evaporation temperature)
PL2	EEV – LOP LOP integration time
PL3	EEV – LOP LOP alarm delay
Manual valve positioning from the supervisor	
PMP	EEV - ADV Enable manual positioning of the expansion valve
PMu	EEV - ADV Manual valve position
Read-only status variables	
PF	EEV - ADV Valve opening steps
Po1	Superheat
Po2	Valve opening percentage
Po3	Superheated gas temperature
Po4	Saturated evaporation temperature
P06	EEV - ADV PWM expansion valve Ton+Toff period

6.3.3 Generic functions

PH EEV – Main Type of refrigerant

Code	UOM	Min	Max	Def.
PH	-	1	14	3

This is used to set the type of gas refrigerant used in the system. The table on the side shows the types of gas possible and the associated PH values. CAREL guarantees perfect compatibility of the CAREL E²V electronic expansion valve with the refrigerants shown below. Contact CAREL if installing E²V valves in systems that use refrigerants not listed in the table E²V.

Type of refrigerant

PH	Refrigerant	Compatibility with CAREL E²V
1	R22	•
2	R134a	•
3	R404a	•
4	R407c	•
5	R410a	•
6	R507a	•
7	R290	
8	R600	
9	R600a	
10	R717	
11	R744	•
12	R728	
13	R1270	
14	R417a	

Tab. 6.g

P1 EEV – Main Select model of electronic valve

Code	UOM	Min	Max	Def.
P1	-	0	2	0

MPXPRO can control two different models of electronic expansion valve, each with the specific type of optional expansion board. Parameter P1 is used to set the model installed:

P1	Model of valve	Model of valve
0		
Valve not used	-	
1	PWM	MX2OPPWM**
2	CAREL E2V	MX2OPSTP**

P3 EEV – PID Superheat set point

Code	UOM	Min	Max	Def.
P3	K	0.0	25.0	10.0

This is used to set the reference superheat value for the control of the electronic valve. It does not determine the actual superheat value, but rather the desired value.

MPXPRO, with PID control, tends to maintain the actual superheat, calculated based on the probe readings, around the value set for this parameter. This is done by gradually varying the opening of the valve based on the difference between the actual superheat and the set point.
Important: The set point value calculated depends on the quality of the installation, the position of the probes and other factors. Consequently, depending on the installation the set point read may deviate from the actual value. Set point values that are too low (2 to 4 K) may cause problems involving the return of liquid refrigerant to the compressor rack.

cP1 EEV – ADV Initial valve position when control starts

Code	UOM	Min	Max	Def.
cP1	%	0	100	30

This is used to set the position of the valve as a percentage when control starts. High values ensure intense and immediate cooling of the evaporator when each call is sent, however may cause problems if the valve is oversized with reference to the cooling capacity of the unit. Low values, on the other hand, allow a more gradual and slower action.

Pdd EEV–ADV Initial valve position maintenance time after defrost

Code	UOM	Min	Max	Def.
Pdd	min	0	30	10

At the end of a defrost, during the dripping phase, the expansion valve can be forced open to the initial value set for "cP1" for a time equal to "Pdd". This means greater immunity of the instrument to return of liquid to the compressor rack due to an excessively high evaporator temperature.

PSb EEV – ADV Valve standby position

Code	UOM	Min	Max	Def.
PSb	steps	0	400	7

This indicates the position, as the absolute number of steps, that the valve must move to after having completely closes, to restore the elastic operating conditions of the valve spring, by releasing the compression (for stepper valve only).
Note: the value of this parameter represents the absolute position of the valve during the closing phase (value read using the advanced parameter 'PF').

A🛠 PF: EEV - ADV passi apertura valvola, p. 51

Phr EEV–ADV Enable fast update of the valve parameters to supervisor

Code	UOM	Min	Max	Def.
Phr	flag	0	1	0

In a network of instruments, Phr should not be enabled on all the instruments indiscriminately, but rather one at a time and only for service and test operations

This is used to enable the fast update to the supervisor of the variables relating to the electronic expansion valve, such as:
- PF - absolute position in number of steps (for stepper valves only),
- Po1 - superheat
- Po2 - position as a percentage,
- Po3 - superheated gas temperature,
- Po4 - saturated evaporation temperature,

Useful in commissioning phase or start-up:
Phr = 0: fast update disabled (update every 30 s)
Phr = 1: fast update enabled (update every 1 s)

OSH EEV – ADV Superheat Offset for modulating thermostat

Code	UOM	Min	Max	Def.
OSH	K	0.0	60.0	0.0

B🛠 rd: Temperature set point differential, p. 27
A🛠 P3- EEV - PID superheat set point, p. 45

This function is used to reduce or completely eliminate the typical temperature swings caused by sudden activation/deactivation of the solenoid valve. The function is activated based on the refrigeration unit control temperature and affects the cooling capacity of the electronic valve. In particular, the function is activated when the control temperature falls below half of the differential rd. In this band, the superheat set point P3 is increased by the parameter OSH. The effect of this action is the gradual advanced closing of the electronic valve, which makes the decrease in temperature inside of the refrigeration unit slower and more stable. In this way, the actual temperature of the cabinet can be kept very stable and near the set point, without ever having to close the solenoid valve, but rather by simply controlling the flow of refrigerant.

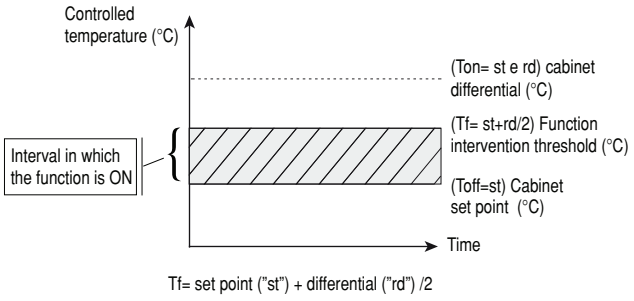

Controlled temperature (°C)
(Ton= st e rd) cabinet differential (°C)
(Tf= st+rd/2) Function intervention threshold (°C)
Interval in which the function is ON
(Toff=st) Cabinet set point (°C)
Time
Tf= set point ("st") + differential ("rd") /2

Fig. 6.g

Note:
- The action of OSH is weighted, based on the difference between the temperature set point and the control temperature. The lower the difference, the greater the action of OSH and vice-versa.
- OSH is active in a band at maximum equal to half of the differential rd
- With double thermostat active, the action of OSH will be determined by the thermostat with the lower difference between the set point and the actual temperature.

Application example:

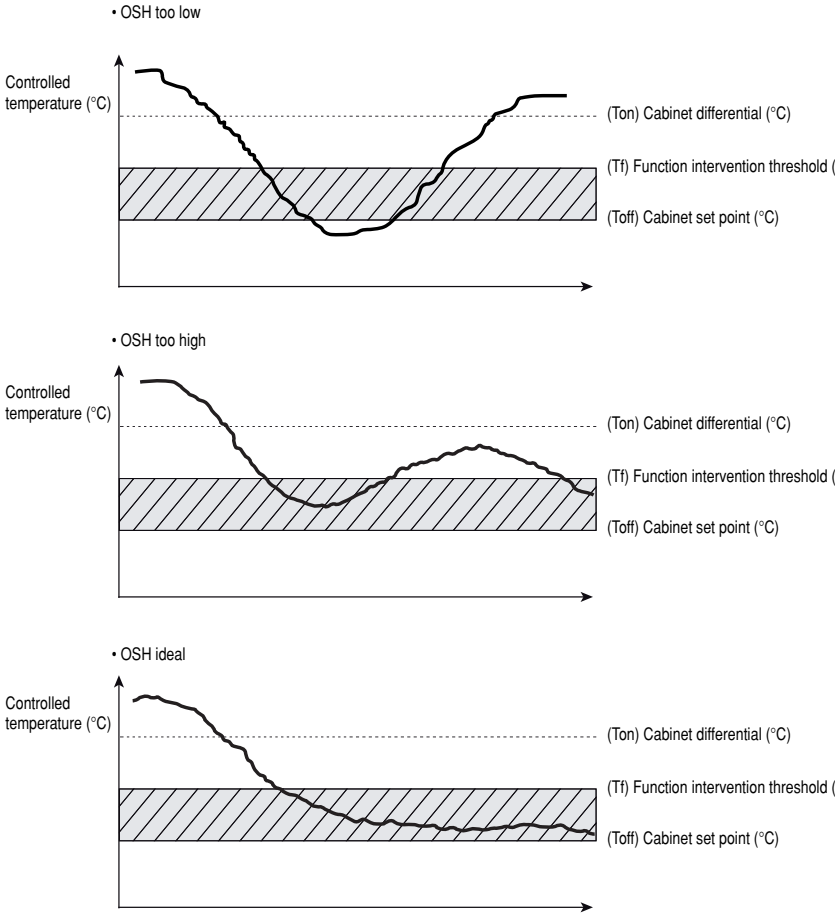

• OSH too low
Controlled temperature (°C)
(Ton) Cabinet differential (°C)
(Tf) Function intervention threshold (
(Toff) Cabinet set point (°C)
• OSH too high
Controlled temperature (°C)
(Ton) Cabinet differential (°C)
(Tf) Function intervention threshold (
(Toff) Cabinet set point (°C)
• OSH ideal
Controlled temperature (°C)
(Ton) Cabinet differential (°C)
(Tf) Function intervention threshold (
(Toff) Cabinet set point (°C)

Fig. 6.h

P15 EEV – Main Support saturated temp. in the event of pressure probe error

Code	UOM	Min	Max	Def.
P15	°C/°F	-50.0	50.0	-8.0

In the event of a pressure/saturated evaporation temperature probe error, this represents the constant value used by the device to simulate the probe reading. In centralised systems, the evaporation pressure is determined by the compressor rack set point. Once this set point has been set for P15, control can continue, even if not in perfect conditions, in emergency situations.

6.3.4 Control

The opening of the electronic valve is controlled based on the difference between the superheat set point and the actual superheat calculated by the probes.
The speed of variation, the reactivity and the ability to reach the set point depend on three parameters.

Kp = proportional gain - parameter P4
Ti = integration time - parameter P5
Td = differential time - parameter P6

The ideal values to be set vary depending on the applications and the utilities managed, nonetheless default values are proposed that allow good control in the majority of cases. For further details, see classic PID control theory.

P4 EEV – PID Proportional gain

Code	UOM	Min	Max	Def.
P4	-	0.0	100.0	15.0

This represents the amplification factor. It determines an action that is directly proportional to the difference between the set point and the actual superheat value. It acts on the speed of the valve, in terms of steps/°C. The valve moves P4 steps for every degree centigrade variation in the superheat, opening or closing whenever the superheat increases or decreases respectively. It also acts on the other control factors, and is valid in both normal control and with all emergency control functions.
High values ⟹ fast and reactive valve (e.g. 30 for applications CO_2 - carbon dioxide)
Low values ⟹ slow and less reactive valve
Example. For CO_2 - carbon dioxide applications: P4=30

P5 EEV – PID Integration time

Code	UOM.	Min	Max	Def.
P5	s	0	900	150

This represents the time required by the controller to balance the difference between the set point and the actual superheat. It practically limits the number of steps that the valve completes each second. It is

only valid during normal control, the special functions in fact have their own integration time.
High values ⟹ slow and less reactive valve
Low values ⟹ fast and reactive valve (e.g. 200 for CO_2 - carbon dioxide applications)
P5 = 0 ⟹ integration action disabled
Example. For CO_2 - carbon dioxide applications: P5=200

P6 EEV – PID Derivative time

Code	UOM	Min	Max	Def.
P6	s	0.0	100.0	5.0

This represents the reaction of the valve to variations in the superheat. It limits variations that are too fast.
High values ⟹ fast variations allowed
Low values ⟹ fast variations limited
P6 = 0 ⟹ differential action disabled
Example. For CO_2 - carbon dioxide applications: P6=5

6.3.5 Safety functions and alarms

• LSH – Low superheat

To prevent too low superheat values that may cause the return of liquid to the compressor or system instability (swings), a low superheat threshold can be defined, below which a special protection function is activated. When the superheat falls below the threshold, the system immediately enters low superheat status and activates a control action, in addition to normal control, with the aim of closing the electronic valve more quickly. In practice, the intensity of the system "reaction" is increased. If the device remains in low superheat status for a certain period, a low superheat alarm is activated, with the display showing the message 'LSH'. The low superheat signal features automatic reset, when the condition is no longer present or the controller is switched off (standby).
When low superheat status is activated, the local solenoid valve can be forced closed (parameter P10).

A🛠 P10: Enable close solenoid valve for low superheat LSH and/or low suction temperature LSA, p. 49

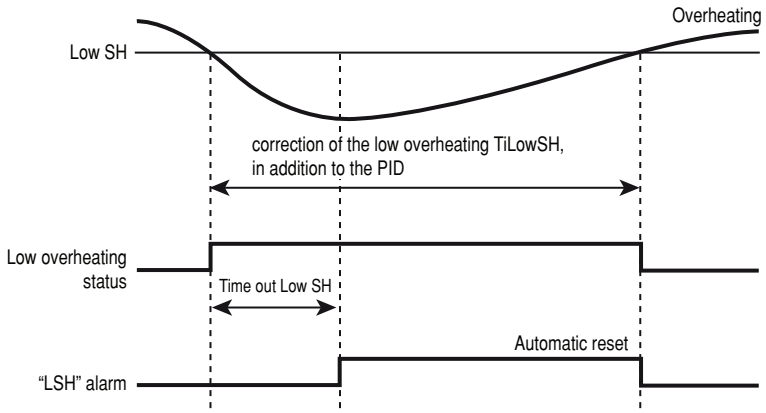


Fig. 6.i

P7 EEV – LSH Low superheat threshold

Code	UOM	Min	Max	Def.
P7	K	-10.0	P3	7.0

This represents the absolute threshold for the activation of the low superheat function.

P8 EEV – LSH Low superheat integration time

Code	UOM	Min	Max	Def.
P8	s	0	240	15

This represents the integration time for the low superheat protection. It is implemented in parallel with the integration time used during normal control. To this must be set to lower values, so as to determine a faster reaction of the electronic valve.
P8 = 0 ⟹ low superheat protection and alarm disabled

P9 EEV – LSH Low superheat alarm delay

Code	UOM	Min	Max	Def.
P9	s	0	999	600

This is the time that **MPX**PRO remains in low superheat status for before activating the corresponding alarm. When the alarm is activated, the following occur:
• Message 'LSH' shown on the display
• The buzzer is activated
The low superheat alarm features automatic reset, that is, it is automatically reset if the alarm condition is no longer present.
P8 = 0 ⟹ low superheat alarm disabled.
This allows the forced closing of the local or network solenoid valve, based on the configuration of the system (see parameter r7) if the low superheat alarm LSH or low evaporation temperature LSA is activated. Forced closing is completed when the alarm is automatically reset, that is, when the superheat returns above the threshold.

• MOP – Maximum evaporation pressure

When starting or restarting an installation, the compressors may not be able to satisfy the simultaneous refrigeration requirements of all the refrigeration utilities in the installation. This may cause an excessive increase in the evaporation pressure and consequently the corresponding saturated temperature. When the evaporation pressure, expressed in degrees (saturated), rises above the threshold, after a certain settable time the system enters MOP protection status: PID superheat control is stopped and the controller starts gradually closing the valve with an integration action to return the evaporation pressure below the threshold. The protection function has been designed to allow a gradual return to normal operating conditions, that is, when the critical conditions have ended, the controller temporarily operates with a higher superheat set point until the function is automatically reset.

Important: if this action causes the complete closing of the electronic valve, the solenoid valve is also closed, even if this is a network solenoid valve, when enabled.
The alarm signal with the message 'MOP' on the display is delayed from the activation of the protection function and is automatically reset as soon as the saturated temperature falls below the threshold.

PM1 EEV – MOP MOP threshold (saturated evaporation temperature)

Code	UOM	Min	Max	Def.
PM1	°C/°F	-50.0	50.0	50.0

This represents the maximum evaporation pressure, expressed in degrees (saturated), above which the MOP protection and alarm are activated (each with its own delay times). The protection is reset semi-automatically, that is, there is a gradual return to normal operation, to avoid the critical situations arising again.

PM2 EEV – MOP MOP integration time

Code	UOM	Min	Max	Def.
PM2	s	0.0	240.0	10

This represents the integration time for the maximum evaporation pressure protection function. This replaces the normal PID control during MOP status.
PM2 = 0 ⟹ MOP protection and alarm disabled.

PM3 EEV – MOP MOP alarm delay

Code	UOM	Min	Max	Def.
PM3	s	0	999	0

This represents the alarm activation delay after exceeding the MOP threshold. When the alarm is activated, the following occur:
• Message 'MOP' shown on the display
• The buzzer is activated
The alarm features automatic reset when the evaporation pressure falls below the threshold PM1.
PM4 = 0 ⟹ MOP alarm disabled

PM4 EEV – MOP MOP function delay when starting control

Code	UOM	Min	Max	Def.
PM4	s	0	240	2

This represents the MOP protection activation delay following the last activation of the solenoid valve.

PM5 EEV – MOP Enable close solenoid local valve for MOP alarm

Code	UOM	Min	Max	Def.
PM5	flag	0	1	0

This allows the local or network solenoid valve, based on the configuration of the system (see parameter r7), to be closed upon activation of the MOP alarm. If the expansion valve (0 steps) is closed completely during MOP status (before the activation of the alarm), the solenoid valve configured is also closed.

LSA – Low evaporation temperature alarm

The low evaporation temperature alarm prevents the return of liquid refrigerant to the compressors. When the evaporation temperature falls below the threshold, the alarm is activated after the set delay, closing the electronic valve and the local and/or shared solenoid valve (if configured). The alarm is reset when the evaporation temperature exceeds the set threshold plus the hysteresis. Reset is automatic for a maximum of three times in a two hour period. Upon the fourth activation in such period, the alarm is saved and requires manual reset from the user terminal or supervisor.

P10 EEV – Main Enable close solenoid valve for low superheat LSH and/or low suction temperature LSA

Code	UOM	Min	Max	Def.
P10	flag	0	1	1

This allows the network solenoid valve to be closed in the event of low superheat status (LSH) and/or low suction temperature alarm (LSA).
• P10=1 (default): the unit that signals the LSH status and/or LSA, as well as closing the local solenoid valve, also sends the signal across the LAN. This enables the propagation of the closing request across the tLAN: to the master and the other slaves.
To enable the closing of the network solenoid valve (P10=1), the solenoid valve on the Master must be configured as a network valve (parameter r7=1), being the only one enabled to accept control signals from the local network.

• P10=0: the unit that signals the LSH status and/or LSA does not enable the closing of the network and local solenoid valve.

P11 EEV – LSA Low suction temperature threshold

Code	UOM	Min	Max	Def.
P11	°C/°F	-50.0	50.0	-45.0

This represents the evaporation temperature below which the alarm is activated, after the corresponding delay. The threshold for resetting the alarm is represented by this threshold plus the hysteresis P13.

P12 EEV – LSA Low suction temperature alarm delay

Code	UOM	Min	Max	Def.
P12	s	0	999	600

This represents the alarm activation delay after exceeding the threshold P11. When the alarm is activated, the following occur:
• The message 'LSA' is shown on the display
• The buzzer is activated
The alarm features automatic reset for the first three activations over a two hour period.
P12 = 0 ⟹ LSA alarm disabled

P13 EEV – LSA Low suction temperature alarm differential (°C)

Code	UOM	Min	Max	Def.
P13	°C/°F	0.0	60.0	10.0

This represents the hysteresis used to reset the LSA alarm.
P13 = 0 ⟹ always automatic reset

• LOP – Minimum evaporation pressure

Function useful above all for stand-alone refrigeration units, used to prevent the evaporation pressure from remaining excessively low for too long. When the evaporation pressure, expressed in degrees (saturated), falls below the threshold, the LOP protection is activated, which adds an integration action to normal PID control, specifically devised to be more reactive as regards the opening of the valve. The PID control remains active, as the superheat must continue to be monitored as to avoid flooding the compressors.
The LOP alarm is delayed from the activation of the protection function, both are reset automatically when the pressure value, in degrees (saturated), exceeds the threshold.

Important: this function is designed for stand-alone refrigeration units, not centralised systems (self-contained units).

PL1 EEV – LOP LOP threshold (saturated evaporation temperature)

Code	UOM	Min	Max	Def.
PL1	°C/°F	-50.0	50.0	-50.0

This represents the evaporation pressure, expressed in degrees (saturated), below which the LOP protection is activated. The protection is deactivated immediately when the pressure exceeds this threshold.

PL2 EEV – LOP LOP integration time

Code	UOM	Min	Max	Def.
PL2	s	0	240	0

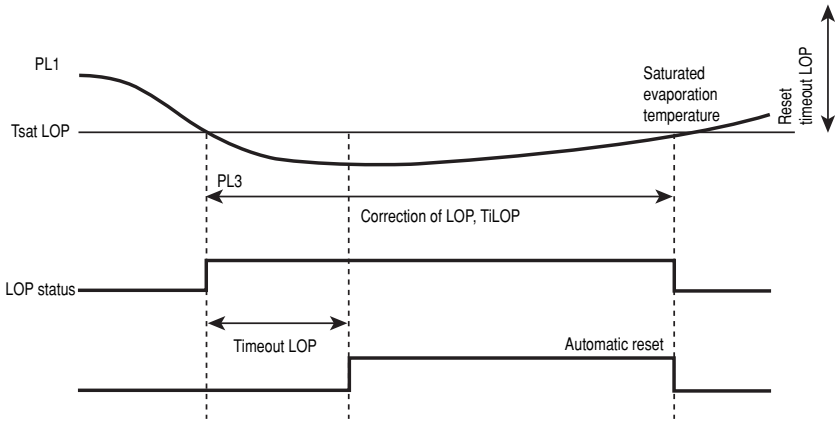


Fig. 6.j

This represents the integration constant used during the activation of the LOP protection. This integration time acts in parallel to normal PID control.
PL2 = 0 ⟹ LOP protection and alarm disabled

PL3 EEV – LOP LOP alarm delay

Code	UOM	Min	Max	Def.
PL3	s	0	240	0

This represents the alarm activation delay after exceeding the LOP threshold. When the alarm is activated, the following occur:
• The message 'LOP' is shown on the display
• The buzzer is activated
The alarm features automatic reset when the evaporation pressure rises above the threshold PL1.
PL3 = 0 ⟹ LOP alarm disabled

6.3.6 Manual valve positioning from the supervisor

PMP EEV - ADV Enable manual positioning of the expansion valve

Code	UOM	Min	Max	Def.
PMP	-	0	1	-

This is used to enable/disable the positioning of the valve, cancelling the activation of any control function or alarm.

- PMP = 0: manual positioning disabled
- PMP = 1: manual positioning enabled

PMu EEV - ADV Manual valve position

Code	UOM	Min	Max	Def.
PMu	-	0	600	-

If manual positioning is enabled, this is used to set the manual opening of the electronic valve. The value is expressed in steps for stepper valves, and as a % for PWM valves.

6.3.7 Read-only status variables

PF EEV - ADV Valve opening steps

Code	UOM	Description	Min	Max	Def.
PF	-	Absolute valve position	0	480	-

Status variable that only displays, solely from the supervisor, the current position of the electronic valve calculated by the controller. System malfunctions may cause this value to be different from the effective position of the valve. Not used with PWM valves.

Po1 Superheat

Code	UOM	Description	Min	Max	Def.
Po1	K	Superheat	-	-	-

Status variable that only displays of the superheat value calculated by **MPX**PRO and used to control of the valve.

Po2 Valve opening percentage

Code	UOM	Description	Min	Max	Def.
Po2	%	Valve opening as a percentage	-	-	-

Status variable that only displays the electronic valve opening as a percentage.

Po3 Superheated gas temperature

Code	UOM	Description	Min	Max	Def.
Po3	°C/°F	Evaporator outlet temperature	-	-	-

Status variable that only displays the evaporator outlet temperature read by the corresponding probe (advanced parameter /Fd).

A🛠 /Fd - /FE: Assign advanced probe functions, p. 37

Po4 Saturated evaporation temperature

Code	UOM	Description	Min	Max	Def.
Po4	°C/°F	Saturated evaporation temperature	-	-	-

Status variable that only displays the saturated evaporation temperature calculated by the corresponding evaporation pressure probe or read directly by the NTC probe (advanced parameter /FE).

Po6 EEV – ADV PWM expansion valve Ton +Toff

Code	UOM	Min	Max	Def.
Po6	s	1	20	6

This represents the period of modulation (in seconds) for the PWM expansion electronic valve (DC/AC) only. The opening of the PWM valve is controlled based on the same PID parameters, and refers to the period Po6 (in seconds) and not the 480 steps representing the maximum opening of the stepper valve. All the comments made for the stepper valve can thus be applied to the PWM valve, considering these differences.

6.3.8 Power failure

The electronic valve requires a power supply to be able to open or close. In the event of power failures, it remains in the current position. Consequently a solenoid valve is required, upstream of each individual evaporator or master-slave network, to close the circuit and ensure the safety of the installation in the event of mains power failures. For further information, see the instruction sheet on the electronic valve (code +050000340). Alternatively, a backup battery can be installed that provides power for enough time to close the valve. When next restarted, the system is automatically rebooted and resumes normal control.

6.4 Compressor

This section describe the advanced settings that are useful if **MPX**PRO is used in non-centralised systems, that is, where the compressor operating times are managed to avoid sudden starts/stops that may cause damage. In this section, the compressor/control output is assumed to be connected directly to a compressor.

function of parameter c0:

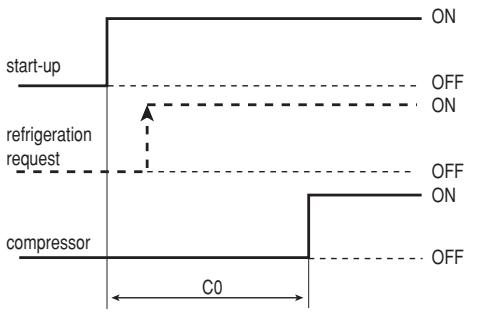


Fig. 6.k

function of parameter c1:

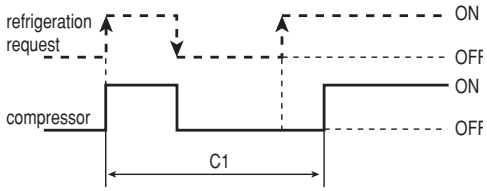


Fig. 6.l

function of parameter c2:

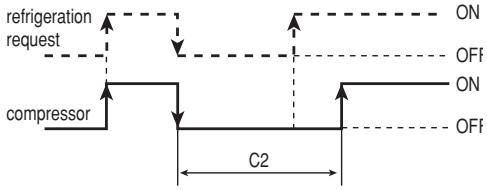


Fig. 6.m

function of parameter c3:

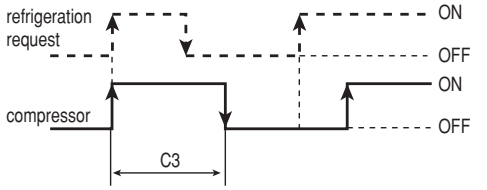


Fig. 6.n

A🛠 c4: ON time for duty setting operation, p. 43

6.4.1 List of parameters

Code	Paramenter
c0	Enable compressor and fan delay on power-up
c1	Minimum time between successive starts
c2	Minimum off time
c3	Minimum on time
d9	Disable defrost priority over solenoid times
A6	Configure solenoid control during external alarm (immediate or delayed)

6.4.2 General functionsi

c0 Enable compressor and fan delay on power-up

Code	UOM	Min	Max	Def.
c0	min	0	240	0

This is used to set a minimum activation delay of the compressor/control output after switching on the instrument. In a system with multiple compressors, c0 can be set to stagger the starts of the compressors (see Fig. 6.k). This prevents the compressors from starting too close together in the case of frequent power failures. The delay, if enabled, naturally also affects the activation of the output fans, if suitably configured.

c1 Minimum time between successive starts

Code	UOM	Min	Max	Def.
c1	min	0	15	0

This establishes the minimum interval between two consecutive activations of the compressor, regardless of the temperature and the set point. Each start call in this period will be postponed until the delay elapses (see Fig. 6.l).

c2 Minimum off time

Code	UOM	Min	Max	Def.
c2	min	0	15	0

This establishes the minimum interval between when the compressor stops and starts again. During this interval, the compressor will remain off, regardless of the temperature and the set point (see Fig. 6.m). Parameter c2 is useful for balancing the pressure after the compressor stops, in systems with hermetic and capillary compressors.

c3 Minimum on time

Code	UOM	Min	Max	Def.
c3	min	0	15	0

This represents the minimum compressor running time. No compressor stop calls will be accepted until the set time has elapsed (see Fig. 6.n).

d9 Disable defrost priority over solenoid times

Code	UOM	Min	Max	Def.
d9	flag	0	1	1

Disables the compressor protection times when the defrost is called. This is useful for hot gas defrosts.
1. d9 = 0: the protection times are observed
2. d9 = 1: the protection times are not observed, the defrost has higher priority

A6 Configure solenoid control during external alarm (immediate or delayed)

Code	UOM	Min	Max	Def.
A6	min	0	100	0

If an external alarm is activated (both immediate and delayed), control is normally stopped for the duration of the alarm. Parameter A6 can be used to activate control for a time equal to the value of A6 (ON time), followed by a fixed pause of 15 min (OFF time). This is similar to the duty setting function (advanced parameter c4)
- A6 = 0 in the event of external alarms, the compressor is always off
- A6 =100 in the event of external alarms, the compressor is always on (the 15 min. off time is skipped).

Note:
- During operation in A6, the fans continue to operate according to the set configuration.
- A6 has priority over c4 (duty setting), in the event of simultaneous external alarms and breakage of the control probes, the action of parameter A6 is implemented.

6.5 Defrost

This section describes the advanced functions concerning the defrost

6.5.1 List of parameters
6.5.2 General parameters
6.5.3 Second evaporator
6.5.4 Special functions:
- Skip Defrost
- Running Time
- Sequential Stops
- Power Defrost

6.5.1 List of parameters

Code	Parameter
General parameters	
d2	Enable end defrost synchronised by Master
d4	Enable defrost on start-up
d5	Defrost delay on start-up if enabled
dC	Time base for defrost
dd	Dripping time after defrosting (fans off)
Second evaporator	
d/2	Second evaporator defrost probe
dt2	Second defrost end temperature (read by Sd2)
dP2	Maximum defrost duration on second evaporator
Special functions Skip Defrost	
d7	Enable "Skip defrost"
dn	Nominal duration of the defrost in "Skip defrost" mode
Running Time	
d10	Defrost time in "Running time" mode
d11	Defrost temperature threshold in "Running time" mode
Sequential Stops	
dS1	Compressor off time in "Sequential stop" defrost mode
dS2	Compressor operating time in "Sequential stop" defrost mode
Power Defrost	
ddt	Additional end defrost temperature delta in "Power defrost" mode
ddP	Additional maximum defrost time delta in "Power defrost" mode

6.5.2 General parameters

d2 Enable end defrost synchronised by Master

Code	UOM	Min	Max	Def.
d2	flag	0	1	1

At the end of a network defrost, the single slave unit can decide whether to wait for the end defrost signal from the master or end the defrost independently from the others.
- d2 = 0 end defrost independently
- d2 = 1 end defrost on signal from master

d4 Enable defrost on start-up

Code	UOM	Min	Max	Def.
d4	flag	0	1	0

Enable the activation of a defrost when the instrument is switched on.
- d4 = 0 defrost on start-up not enabled
- d4 = 1 defrost on start-up enabled

If enabled on the master, this refers to a network defrost; while on a slave it is only a local defrost.
The defrost on start-up has priority over the compressor safety times.

d5 Defrost delay on start-up if enabled

Code	UOM.	Min	Max	Def.
d5	min	0	240	0

This represents the delay that affects:
- the activation of a defrost after switching on the instrument;
- the activation of a defrost after the call signal from digital input;
- the enabling of the defrost from digital input.

It can be set differently on the master and the slaves to stagger the defrost start timed on the different units in the local network.

dC Time base for defrost

Code	UOM	Min	Max	Def.
dC	flag	0	1	0

This is used to modify the unit of measure used for the defrost parameters, as per the table:

	dI	dP1	dP2	ddP
dC = 0	hours	minutes		
dC = 1	minutes	seconds		

B dI, dPI: Interval between consecutive defrosts, p. 29
A dP2: Maximum defrost duration on second evaporator, p. 54
A ddP Additional maximum defrost time delta in "Power defrost" mode, p. 56

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dd Dripping time after defrosting (fans off)

Code	UOM	Min	Max	Def.
dd	min	0	15	2

This defines the interval in minutes during which the compressor and the evaporator fans are forced off after defrosting, so as to allow the evaporator to drip.
If dd=0 no dripping time is enabled, and at the end of the defrost control resumes immediately.

6.5.3 Second evaporator

MPXPRO is used to manage separate defrosts on two evaporators in parallel.
This specific configuration is only allowed if an electronic expansion valve is not used, and therefore control is performed on the two thermostatic valves or directly on the solenoid valve. With this function enabled, the defrosts on the two evaporators can be performed independently, with different end defrost thresholds and maximum durations. Naturally, two separate auxiliary outputs must be used (see basic parameters H1-H5-H7) and a temperature probe must be installed on the second evaporator (see advanced parameter /FF).

d/2 Second evaporator defrost probe

Code	UOM	Min	Max	Def.
d/2	°C/°F	-	-	-

This is used to display the temperature measured by the second evaporator defrost probe configured using advanced parameter /FF.

dt2 Second defrost end temperature (read by Sd2)

Code	UOM	Min	Max	Def.
dt2	°C/°F	-50.0	50.0	8.0

B🛠 dt1: End defrost temperature, p. 29

This represents the end defrost threshold for the second evaporator.
The same remarks made for the threshold on the main evaporator are valid, see basic parameter dt1.

B🛠 dP1: Maximum defrost duration, p. 30

dP2 Maximum defrost duration on second evaporator

Code	UOM	Min	Max	Def.
dP2	min	1	240	45

This represents the maximum defrost duration on the second evaporator.
The same remarks made for dP1 are valid.

6.5.4 Special functions

As well as the normal defrost functions, **MPX**PRO features of a series of special functions used in situations in which specific types defrost of required. These functions are:
1. "Skip defrost": function used to avoid unnecessary defrosts
2. "Running time": automatic start defrost call based on current operation
3. "Sequential stops": defrost performed by sequential stops in control
4. "Power defrost": More effective defrosts

• Skip Defrost

The Skip Defrost function is used to avoid unnecessary defrosts. It can be used for defrosts that end by temperature, and monitors the duration of the previous defrost, identified by the time taken by the refrigeration unit to reach the end defrost threshold, establishing whether or not the next defrosts are necessary. The decisive duration is determined by parameter dn, which expresses the duration as a percentage (of the maximum duration 'dP1' and 'dP2') below which the next defrosts are skipped. This function observes the following rules:
- If the duration of the current defrost is less than 'dn', the next defrost is skipped;
- If when the next defrost is performed, the duration is still less than dn, then two consecutive defrosts are skipped;
- This procedure is repeated until reaching a maximum of three defrosts, the fourth is always performed;
- On power-up, the control always performs the first 7 defrosts.

Below is an example of the sequence.

dE= effective defrost duration

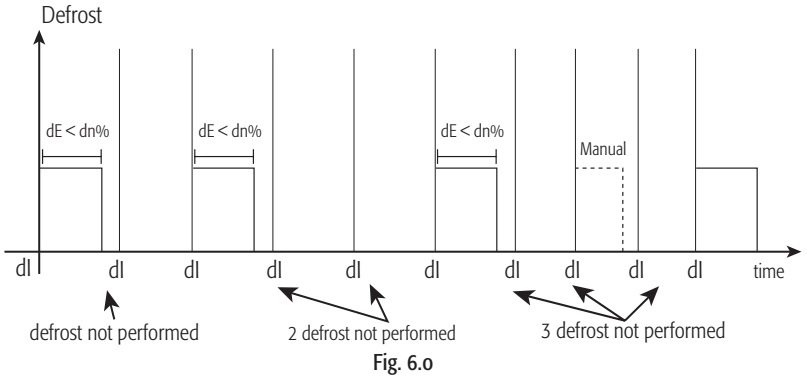

Fig. 6.o

The figure shows an example in which the defrost is activated based on the cyclical parameter dI. Naturally, this function is enabled for all possible activations, apart from the defrost from keypad or supervisor, and these are always performed regardless of this function.
Skip Defrost is not recommended for programmed defrosts, as important defrosts may be skipped before long periods in which no defrost is programmed.

d7 Enable "Skip defrost"

Code	UOM	Min	Max	Def.
d7	flag	0	1	0

Enable Skip defrost function:
- d7 = 0 Skip defrost disabled
- d7 = 1 Skip defrost enabled

dn Nominal duration of the defrost in "Skip defrost" mode

Code	UOM	Min	Max	Def.
dn	%	0	100	75

The nominal duration represents the critical threshold below which the next defrost can be skipped. The value is expressed as a percentage and is based on parameter dP1 (maximum defrost duration on main evaporator) or dP2 (maximum defrost duration on auxiliary evaporator), depending on the evaporator in question.
To determine the effective value of the nominal duration (corresponding to the main evaporator)

$$dn1 = \frac{dn}{100} \bullet dP1$$

The remarks are identical for the second evaporator.

$$dn2 = \frac{dn}{100} \bullet dP2$$

• Running time

Running time is a special function that allows **MPX**PRO to determine when the refrigeration unit needs defrosting. In particular, it is assumed that if the evaporator temperature remains continuously below a certain set threshold (d11) for a certain time (d10), the evaporator may be excessively frosted. Defrosting in this situations may resolve the problem. To the side is the graph that explains the operating principle.

d10 Defrost time in "Running time" mode

Code	UOM	Min	Max	Def.
d10	min	0	240	0

This indicates the time during which control remains active when the evaporation temperature is lower than the value set for d11. When the time set for d10 has elapsed, a defrost call will be sent, and the defrost performed in the mode set in the defrost section. The count is reset if the temperature returns above the threshold.
d10 = 0 running time disabled

d11 Defrost temperature threshold in "Running time" mode

Code	UOM	Min	Max	Def.
d11	°C/°F	-50.0	50.0	-30.0

This indicates the evaporator temperature threshold below which the controller starts counting the time d10 for the automatic activation of a defrost. Naturally, the evaporator temperature (defrost temperature) is the value measured by the defrost probe Sd installed in contact with the evaporator and configured with parameter /Fb.

• Sequential stops

Sequential stop mode is especially useful for high-normal temperature refrigeration units, and is based on the intelligent stopping of control to allow the evaporator to defrost naturally by the flow of ambient air only, without activating the defrost output and consequently the defrost heaters.
When control stops, the operation of the fans depends on the setting of parameter F3.
If the function is enabled (parameter dS1≠0), two counters are activated.
1. dS1: for the stop control time, on hold during operation;
2. dS2: for the control operating time, on hold during the periods when control is stopped.

The purpose of this new function is stop control and allow natural defrosts only when necessary. The old procedure, in fact, which only counted the control operating time, was in some cases inefficient due to brief periodical stops that reset the counter but did not ensure correct defrosting.

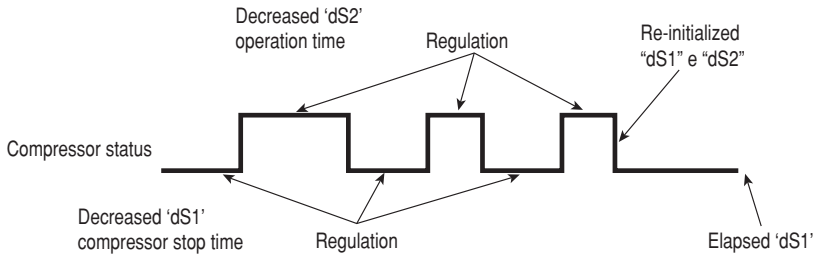

Fig. 6.q

The purpose of this new function is stop control and allow natural defrosts only when necessary. The old procedure, in fact, which only counted the control operating time, was in some cases inefficient due to brief periodical stops that reset the counter but did not ensure correct defrosting **MPX**PRO, sequential stops function, and in fact with control active for an extended period, the effect of this function is exactly the same as before.
If two evaporators are managed in parallel, two independent counters are activated on the evaporators, and the behaviour is identical for both.

B🛠 dP1: Maximum defrost duration, p. 30
A🛠 dP2: Maximum defrost duration on second evaporator, p. 54

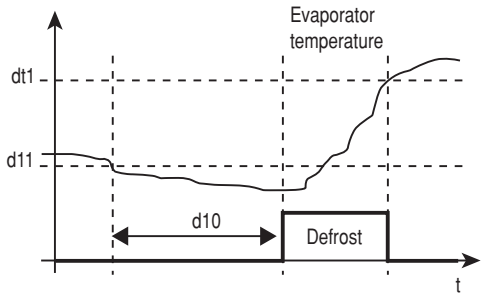

Fig. 6.p

paragraph 5.3 Defrost, p. 28

B🛠 /Fb: Assign defrost temperature probe (sd), p. 37

dS1 Compressor off time in "Sequential stop" defrost mode

Code	UOM	Min	Max	Def.
dS1	min	0	45	0

This represents the initial counter starting time in relation to the control stop time and the effective stop time when reaching the maximum time 'dS2' for the activation of control.
dS1 = 0 Sequential stops disabledi

dS2 Compressor operating time in "Sequential stop" defrost mode

Code	UOM	Min	Max	Def.
dS2	min	0	240	120

This represents the value initial counter starting time in relation to the control operating time, after which a natural defrost is performed in sequential stops mode.
dS2 is only active if dS1≠ 0.

B dt1-dP1: End defrost temperature - Maximum defrost duration, p. 29
A dt2-dP2: End defrost temperature - Maximum defrost duration, second evaporator, p. 54
B td1…td8: Defrost events 1 to 8, p. 30

• Power defrost

Power defrost is a special function on the **MPX**PRO that increases the end defrost threshold dt1 (dt2 for the second evaporator) and/or the maximum defrost duration dP1 (dP2 for the second evaporator). These increases allow longer and more effective defrosts. Power defrosts are performed upon each defrost call in night status or when suitably configured by the RTC parameters (td1 to td8), to allow the user to choose the most suitable conditions for this special procedure. Power Defrost is enabled when at least one of the set increases, ddt or ddP, is other than zero.

ddt Additional end defrost temperature delta in "Power defrost" mode"

Code	UOM	Min	Max	Def.
ddt	°C/°F	-20.0	20.0	0.0

This sets the temperature value that is added to the end defrost threshold dt1 (dt2 for the auxiliary evaporator).
Example. ddt = 0 °C: increased threshold not active in Power defrost

ddP Additional maximum defrost time delta in "Power defrost" mode"

Code	UOM	Min	Max	Def.
ddP	min	0	60	0

This represents the time that is added to the maximum defrost duration dP1 (and dP2 for the auxiliary evaporator).
Example. ddP= 0: increased duration not active in Power defrost
Example 2. If ddt>0 and ddP>0, then Power Defrost mode is enabled for both temperature and duration. In this mode, any defrost calls when the controller is in night status or due to the RTC settings (td1 to td8) with attribute P=1 modify the default settings.
The end defrost threshold temperature becomes

dt1P = dt1 + ddt

The maximum duration of defrost becomes

dP1P = dP1 + ddP

This effect is naturally extended to the second evaporator (dt2 and dP2).

6.6 Fan speed modulation

6.6.1. List of parameters

Code	Parameter
Speed modulation	
F5	Fan cut-off temperature (hysteresis 1°C)
F6	Maximum fan speed
F7	Minimum fan speed
F8	Fan peak speed time
F9	Select fan control with PWM output1/2 (with phase cutting speed control)

MPXPRO board models, p. 10

6.6.2 Speed modulation

MPXPRO can manage a maximum of 3 analogue outputs (this depends on the code of the board used):
– 1 0 to 10 Vdc output on the optional boards
– 2 PWM outputs (12V) on the main board
The modulation of the evaporator fan speed is one of the functions of these outputs and, in particular, based on the standard factory configuration, modulation is managed using the 0 to 10 Vdc analogue output on some optional boards. This unit configuration can only be changed using the commissioning tool or programming key. In this mode, modulation can also be managed using the open collector/PWM outputs. The modulation management algorithm is independent of the output used.

F5 Fan cut-off temperature (hysteresis 1°C)

Code	UOM	Min	Max	Def.
F5	°C/°F	F1	50.0	50.0

This represents the temp. threshold above which the fans are stopped with speed control.

F6-F7 Maximum and minimum fan speed

Code	UOM	Min	Max	Def.
F6 (maximum)	%	F7	100	80
F7 (minimum)	%	0	F6	10

These represent the maximum speed (F6) and minimum speed (F7) of the fans, expressed as a % of the output. Their meaning depends on the type of output used:
- 0 to 10 V – the output voltage at maximum or minimum speed.
- PWM - maximum or minimum portion of the semi-wave applied to the load..

F8 Fan peak speed time

Code	UOM	Min	Max	Def.
F8	s	0	240	0

When fans are started, this sets the operating time at maximum speed. The function is especially useful to overcome the mechanical inertia of the motor when starting.
F8 = 0 speed always managed by the controller.

F9 Select fan control with PWM output1/2 (with phase cutting speed control)

Code	UOM	Min	Max	Def.
F9	flag	0	1	1

If controlled via a PWM output, this indicates the type of control used:
F9 = 0 control by duration for inductive loads
F9 = 1 control by pulses for capacitive loads
The figure below shows a comparison between the two types of control. Control by duration manages the fan speed based on the duration of the output pulse, while control by pulses, on the other hand, determines the speed based on the position of the pulse in relation to the semi-wave.

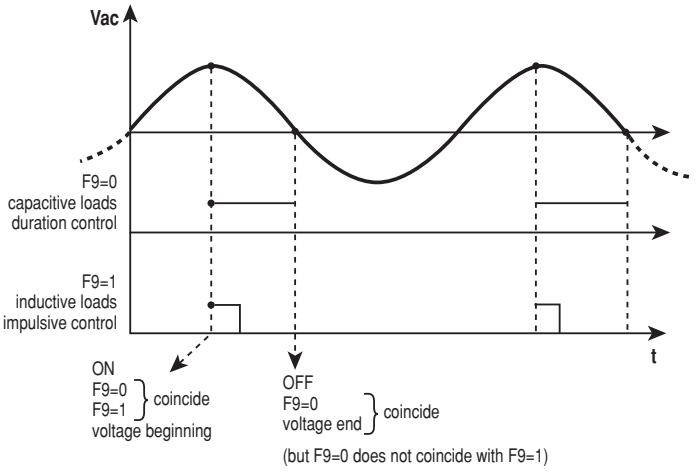

Fig. 6.s

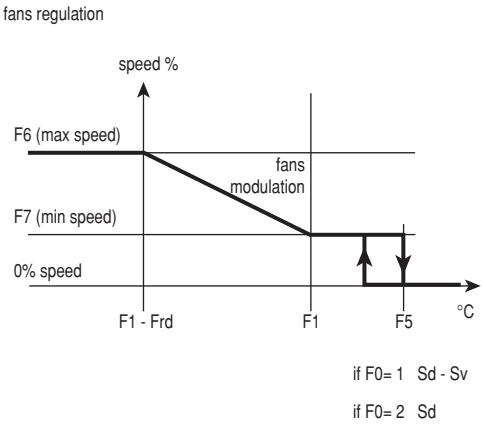

Fig. 6.r

6.7 Alarms

This section describes the settings regarding the alarms:
6.7.2 Temperature monitoring
6.7.3 Advanced alarms

6.7.1 List of parameters

Code	Parameter
Temperature monitoring	
r5	Select maximum and minimum temperature monitoring probe
rt	Duration of the current maximum and minimum temperature monitoring session
rH	Maximum temperature acquired in the session
rl	Minimum temperature acquired in the session
Advanced alarms	
r3	Enable end defrost signal by timeout
AL2	Low temperature alarm threshold on intake probe Sr (only in "Double thermostat" mode)
AH2	High temperature alarm threshold on intake probe Sr (only in "Double thermostat" mode)
Ar	Enable alarms to be sent from slaves to master
HS0...HS9	Alarm log parameters

6.7.2 Temperature monitoring

MPXPRO allows the continuous and direct monitoring of any of the probes. It saves the maximum and minimum values measured to specific variables that are then directly accessible from the terminal.

r5 Select minimum and maximum temperature monitoring probe

Code	UOM	Min	Max	Def.
r5	-	0	10	0

This setting identifies the probe used for maximum and minimum temperature monitoring:

r5	Monitoring probe
0	disabled (default)
1	Control (Sreg)
2	Virtual (Sv)
3	Outlet (Sm)
4	Defrost (Sd)
5	Intake (Sr)
6	Evaporation (superheated gas, Tsuct)
7	Saturated evaporation (Tevap)
8	Auxiliary defrost
9	Auxiliary
10	Auxiliary 2

Tab. 6.h

Important: Once having exceeded the maximum time of 999 hours, monitoring continues while the value displayed is locaked on 999

rt Duration of the current maximum and minimum temperature monitoring session

Code	UOM	Min	Max	Def.
rt	hours	0	999	-

This is used to display how many hours the monitoring has been active for and is consequently the reference interval for the values measured. Monitoring can be reset directly from the keypad by pressing DOWN for 5 seconds. This is indicated by the message 'rES' on the display.

Read-only parameter

rH-rL Minimum and maximum temperature acquired in the session

Code	Description	UOM	Min	Max	Def.
rH	Maximum temperature	°C/°F	-	-	-
rL	Minimum temperature	°C/°F	-	-	-

Displays the maximum (rH) and minimum (rL) temperature measured by the probe being monitored (selected by par. r5).

6.7.3 Advanced alarms

r3 Enable end defrost signal by timeout

Code	UOM	Min	Max	Def.
r3	flag	0	1	0

B🛠 d0: Select type of defrost, p. 29

If the defrost is set to end by temperature (d0=0/1), this enabled the signalling of messages 'Ed1' and 'Ed2' that indicate end defrost by timeout.
- r3 = 0 Ed1 and Ed2 disabled
- r3 = 1 Ed1 and Ed2 enabledi

AL2 Low temp. alarm threshold on intake probe Sr ("Double thermostat" only)

Code	UOM	Min	Max	Def.
AL2	°C/°F	-50.0	50.0	0.0

B🛠 AL-AH: Low temperature alarm threshold - High temperature alarm threshold, p. 33

In Double Thermostat mode, parameter AL (high temperature alarm threshold) refers to the outlet probe Sm only. AL2 is identical to this for the intake probe Sr.

AH2 High temp. alarm threshold on intake probe Sr ("Double thermostat" only)

Code	UOM	Min	Max	Def.
AH2	°C/°F	-50.0	50.0	0.0

A🛠 Double thermostat, p. 42

In Double Thermostat mode the parameter AH (high temperature alarm threshold) refers to the outlet probe Sm only. AH2 is identical to this for the intake probe Sr.

B🛠 AL-AH: Low temperature alarm threshold - High temperature alarm threshold, p. 33

Ar Enable alarms to be sent from slaves to master

Code	UOM	Min	Max	Def.
Ar	Flag	0	1	1

This can only be set only on master units, and enables the alarms on the slaves to be signalled on the network master. The display on the master will how, alternating with the temperature, the message nx (x: slave address 1 to 4) and the alarm output will be activated, if suitably configured.
- Ar=0 Alarm signal enabled
- Ar=1 Alarm signal disabled

See par. 3.3.5 'Alarm log, p. 17

HS0 to HS9 Alarm log parameters (alarm code, date, activation time, duration)

These parameters are accessed from the alarm log menu. The controller saves the last 10 alarms activated. Scrolling the menu displays the alarm code, the time it was activated, and the duration.

Code	Description	UOM	Min	Max	Def.
HS0…HS9	Alarm log	-	-	-	-
__	Alarm code	-	-	-	-
h_	Hour	hours	0	23	-
n_	minutes	min	0	59	-
__	alarm duration	min	0	999	-

Important: If the RTC board is not installed, the alarm log will not show any information regarding the hour and minutes the alarms were activated.

Example:
HS0: HI press DOWN, h17 press DOWN, m23 press DOWN, 65. This means: Alarm HI was activated at 17:23 and lasted 65 minutes.

6.8 HACCP (Hazard Analysis and Critical Control Point)

HACCP allows control of the operating temperature, recording any anomalies due to power failures or an increase in the temperature due to other causes (breakages, extreme operating conditions, user errors, etc.). Two types of HACCP event are managed:

6.8.2 Type HA HACCP alarms (high temperature during normal operation)
6.8.3 Type HF HACCP alarms (high temperature after a power failure)

When a HA or HF event occurs, the following data are saved:
- hour, minutes and day of the month when the alarm was activated;
- type of alarm;

When an alarm is recorded, the HACCP LED flashes, the display shows the alarm code, the alarm is saved and the alarm relays and buzzer (if featured) are activated. The latter can be reset by pressing the PRG button. If HACCP is enabled (Htd > 0 and the HACCP LED is on).

6.8.1 List of parameters

Code	Description
HA	Date/time of the last HA event
HA1	Date/time of the second-to-last HA event
HA2	Date/time of the third-to-last HA event
HAn	Number of HA alarm events activated
HF	Date/time of the last HF event
HF1	Date/time of the second-to-last HF event
HF2	Date/time of the third-to-last HF event
HFn	Number of HF alarm events activated

6.8.2 Type HA HACCP alarms

The HA alarm is generated when during normal operation the temperature read by the probe set for parameter AA exceeds the high temperature threshold AH for a time Ad + Htd.
Therefore, compared to the normal high temperature alarm already signalled by the control, the type HA HACCP alarm is delayed by a further specific time Htd for HACCP monitoring. This is shown in the figure below.

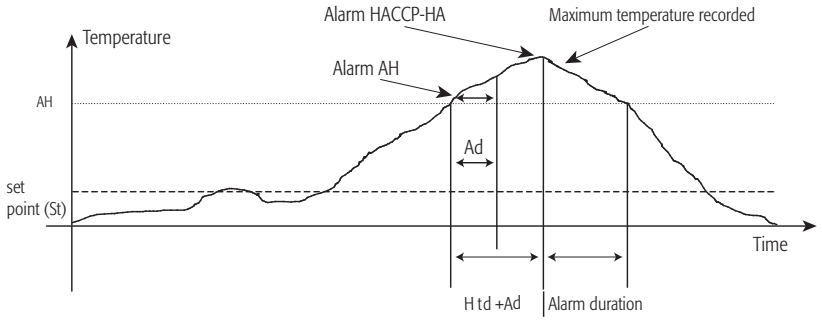

Fig. 6.t

Htd HACCP alarm delay

Code	UOM.	Min	Max	Def.
Htd	min	0	240	0

This represents the additional time for recording a HACCP alarm.
It is therefore recorded after the time Ad+Htd.
Htd = 0 HACCP recording disabled (The HACCP LED is on if Htd > 0).

HA/HA1/HA2 HA alarm events

Alarm code, hour, minutes and duration	UOM	Min	Max	Def.
HA…HA2		-	-	-
y_	Year	0	99	-
M_	Month	1	12	-
d_	Day	1	31	-
h_	Hour	0	23	-
n_	min	0	59	-
___	alarm duration	0	240	-

These parameters are accessed from the HACCP menu. The last 3 alarms can be displayed: alarm code, month, day, hour, minutes, duration of the alarm.
The order of the alarms listed is progressive, HA is the most recent alarm. When the list is full and a new alarm is generated, the oldest one is deleted.

Example:

Code	Alarm code, hour, minutes and duration	Meaning
HA	HA	Indicates that the HA alarm was generated on 6 December 2003 at 11:15 and lasted 199 minutes
y_	03	
M_	12	
d_	06	
h_	11	
n_	15	
___	199	

Tab. 6.i

B🛠 d0: Select type of defrost, p. 29

Read-only parameter

Important: to reset the alarms and for information on navigation, see the HACCP alarms section on p. 18

ENGLISH

Read-only parameter

HAn Number of HA alarms

Code	UOM	Min	Max	Def.
HAn	-	0	15	-

Indicates the number of HA alarm events. A maximum of 15 alarms can be saved, while only the last 3 can be viewed in detail (HA-HA1-HA2).

6.8.3 Type HF HACCP alarms

The type HF HACCP alarm is generated if following a power failure for an extended time (>1 minute) the temperature read by the probe set for parameter AA exceeds the high temperature threshold AH. This therefore records the alarms due to power failures. In this case too, if the Double Thermostat function is active, reference is made to the threshold AH2.

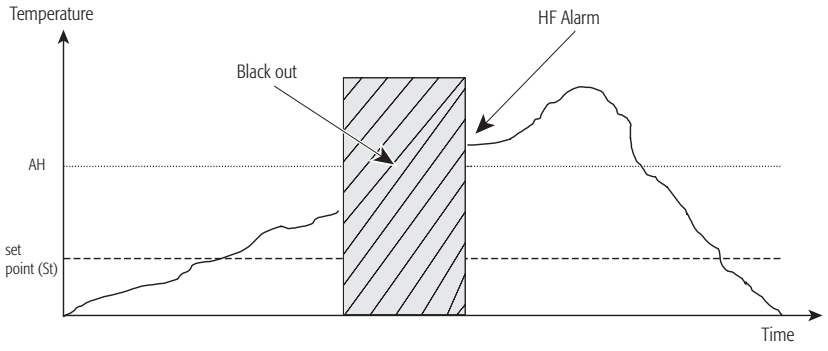

Fig. 6.u

Read-only parameter

HF/HF1/HF2 HF alarm events i

Alarm code, hour, minutes and duration	UOM	Min	Max	Def.
HF…HF2		-	-	-
y_	Year	0	99	-
M_	Month	1	12	-
d_	Day	1	31	-
h_	Hour	0	23	-
n_	min	0	59	-
___	alarm duration	0	240	-

These parameters are accessed from the HACCP menu. The last 3 alarms can be displayed: alarm code, month, day, hour, minutes, duration of the alarm.
The order of the alarms listed is progressive, HF is the most recent alarm. When the list is full and a new alarm is generated, the oldest one is deleted.

Example:

Code	Alarm code, hour, minutes and duration	Meaning
HF	HF	Indicates that the HF alarm was generated on 29 August 2003 at 19:44 and lasted 298 minutes
y_	03	
M_	08	
d_	29	
h_	19	
n_	44	
___	298	

Read-only parameter

HFn Number of HF alarms

Code	UOM	Min	Max	Def.
HFn	-	0	15	-

Indicates the number of HF alarm events.
A maximum of 15 alarms can be saved, while only the last 3 can be viewed in detail (HF-HF1-HF2).

7. PROGRAMMING KEYS AND COMMISSIONING TOOL

The programming key codes IROPZKEY00/A0 can be used to copy the complete set of parameters (values, visibility, possibility to upload) from and to an MPXPRO controllers.
The commissioning tool, on the other hand, is software used to program, manage and monitor the complete status of the MPXPRO series controllers. This software is especially useful when first starting the instrument, by connecting the controller user terminal directly to a PC.

7.1 Programming keys IROPZKEY00/A0

The programming keys IROPZKEY00/A0 (Fig. 7a and 7b) are used to copy the complete set of MPXPRO parameters. The keys must be connected to the connector (4 pin AMP) fitted on the compatible controllers (without powering the controller), and can manage up to 2 different sets of parameters on the instrument. The two dipswitches provided (accessible on removing the battery cover) can be set to perform the following functions:

- Load the parameters for a controller onto the key (see Fig. UPLOAD): the key acquires all the parameters from the controller.
- Copy from the key to a controller (see Fig DOWNLOAD): the key sends the operating parameters to the connected controller.
- Extended copy from the key to a controller (see Fig EXTENDED DOWNLOAD): the key sends all the parameters to the connected controller (both the operating and the unit parameters).

Warning: the parameters can only be copied between instruments with the same code, while the UPLOAD operation can always be performed.
The UPLOAD and/or DOWNLOAD and DOWNLOAD EXTENDED functions are performed as follows:

1. open the rear cover on the key and set the 2 dipswitches according to the desired operation (see Figure 7.c, 7.d, 7.e, UPLOAD, DOWNLOAD, EXTENDED DOWNLOAD);
2. close the cover and insert the key in the connector on the controller;
3. press the button and check the LED: red for a few seconds, then green, indicates that the operation was completed correctly. Other signals or the flashing of the LED indicates that problems have occurred: refer to the corresponding table;
4. at the end of the operation, release the button, after a few seconds the LED goes OFF;
5. remove the key from the controller.

Table of LED signals

LED signal	Error	Meaning and solution
Red LED flashing	Batteries discharged at start copy*	The batteries are discharged, the copy operation cannot be performed. Replace the batteries.
Green LED flashing	Batteries discharged during copy or at end of copy*	During the copy operation or at the end of the operation the battery level is low. Replace the batteries and repeat the operation.
Red/green LED flashing	Instrument not compatible	The parameter set-up cannot be copied as the connected controller model is not compatible. This error only occurs for the DOWNLOAD function; check the code of the controller and run the copy only for compatible codes.
Red and green LED on	Error in data being copied	Error in the data being copied. The data saved on the key are partly/completely corrupted. Reprogram the key.
Red LED on steady	Data transfer error	The copy operation was not completed due to a serious error when transferring or copying the data. Repeat the operation, if the problem persists check the key connections.
LEDs off	Batteries disconnected*	Check the batteries.

* Only on keys with battery.

Tab. 7.a

The key can be programmed not only directly from the MPXPRO controller, but also directly from the PC, using the special converter and the commissioning tool software.
Using this special connection, the PC can completely program the key. In particular, the following functions are possible:

- set the values of the parameters (both unit and operating parameters),
- set the visibility of the parameters,
- set the parameter upload attributes,
- write and read the parameters from/to a file,
- check the parameters.

7.2 Commissioning

MPXPRO can communicate directly with a PC using the "commissioning" port. This connection can be used to program and check the operation of an MPXPRO controller from the PC when installing and first starting the system. The commissioning connection can be used to:

- Set the values, visibility and download attributes of all the parameters, including the unit parameters
- Completely program a key
- During start-up, monitor and manually control all the inputs/outputs
- Update the firmware

A PC can access the commissioning connection via

- The special port available on some terminals/displays
- The RS485 supervisory network

The commissioning software can also be used to program the key. Further information on the operation

Fig. 7.a

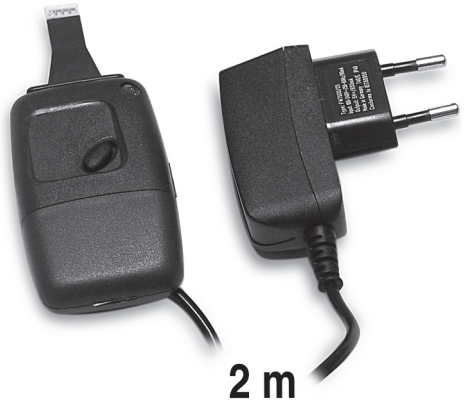

Fig. 7.b

UPLOAD

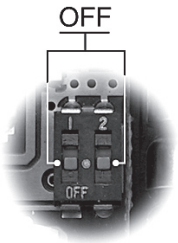

Fig. 7.c

DOWNLOAD

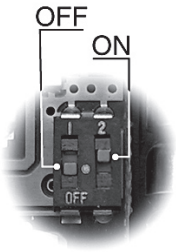

Fig. 7.d

EXTENDED DOWNLOAD

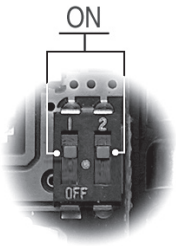

Fig. 7.e

ENGLISH

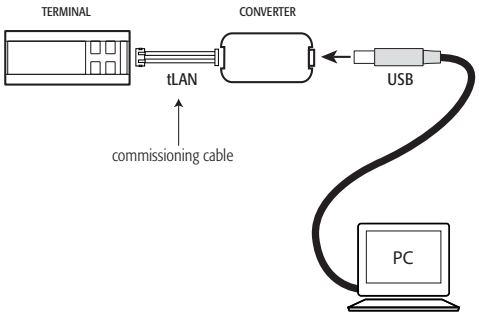

Fig. 7.f

for the connections with the **MPX**PRO board, see p. 12

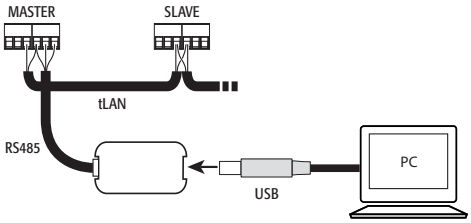

Fig. 7.g

of the commissioning software will be available with software release.

• Commissioning via terminal/display (with IROPZTLN00 converter)

This is used to connect a supervisor PC, running the special software, to an MPXPRO controller via a terminal or display fitted with the commissioning port.

To use this commissioning connection:
- Identify the connection port located under the keypad on the IR* U* and IR* X* terminals/displays (see the figure to the side)
- Connect the USB ports on the converter and the PC using a USB cable

If the PC is connected to a master unit, the software can access the parameters and status variables relating to the master controller, as well as the parameters (unit and operating) and status variables of the slave controllers in the sub-network. If the connection is made to the terminal on a slave, only the parameters (unit operating operation) and status variables of that slave can be accessed.

• Commissioning via the RS485 supervisor port (with CVSTDUMOR0 converter)

As well as the connection via the terminal, MPXPRO can also be connected to a PC via the RS485 supervisory network. In this case, the PC will only be connected to the master unit. Access to the parameters (unit and operating operation) and status variables relating to the slaves connected to the master will be available via the master controller (see the figure to the side).
To use this commissioning connection:
- Connect a master unit (board terminals 20, 21, 22) to the RS485 output on the CVSTDUMOR0 converter, using an RS485 cable.
- Connect the USB ports on the converter and the PC using a USB cable

N.B.: To manage the slave units in the sub-network, make sure that these are correctly connected to the master via the tLAN.

8. ALARMS AND SIGNALS

8.1 Alarms and signals: display, buzzer and relay

Note: The buzzer is activated if enabled by parameter 'H4'.
The alarm relay is activated if one of the outputs, auxiliary 1, auxiliary 2 or auxiliary 3 ('H1', 'H5' and 'H7') has been assigned to the alarm relay function (normally closed or normally open).

Code	Description	Icon on display flashing	Alarm relay	Buzzer	Reset
rE	Virtual control probe fault		ON	ON	AUTO
E1	Probe S1 fault		OFF	OFF	AUTO
E2	Probe S2 fault		OFF	OFF	AUTO
E3	Probe S3 fault		OFF	OFF	AUTO
E4	Probe S4 fault		OFF	OFF	AUTO
E5	Probe S5 fault		OFF	OFF	AUTO
E6	Probe S6 fault		OFF	OFF	AUTO
E7	Probe S7 fault		OFF	OFF	AUTO
E8	Serial probe S8 not updated		OFF	OFF	AUTO
E9	Serial probe S9 not updated		OFF	OFF	AUTO
E10	Serial probe S10 not updated		OFF	OFF	AUTO
E11	Serial probe S11 not updated		OFF	OFF	AUTO
"___"	Probe not enabled	-	OFF	OFF	AUTO
LO	Low temperature alarm (ref. Outlet probe if "Double thermostat")		ON	ON	AUTO
HI	High temperature alarm (ref. Outlet probe if "Double thermostat")		ON	ON	AUTO
LO2	Low temperature alarm (ref. Intake probe if "Double thermostat")		ON	ON	AUTO
HI2	High temperature alarm (ref. Intake probe if "Double thermostat")		ON	ON	AUTO
IA	Immediate alarm from external contact		ON	ON	AUTO
dA	Delayed alarm from external contact		ON	ON	AUTO
dEF	Defrost running	always on	OFF	OFF	AUTO
Ed1	Defrost on evaporator 1 terminated by timeout	-	OFF	OFF	AUTO
Ed2	Defrost on evaporator 2 terminated by timeout	-	OFF	OFF	AUTO
dor	Door open for too long alarm		ON	ON	AUTO
Etc	Real time clock fault		OFF	OFF	AUTO
LSH	Low superheat alarm		OFF	OFF	AUTO
Ldt	Low suction temperature alarm		OFF	OFF	AUTO
MOP	Maximum operating pressure alarm		OFF	OFF	AUTO
LOP	Low suction temperature alarm		OFF	OFF	AUTO
Edc	Communication error with stepper driver		ON	ON	AUTO
EFS	Motor controlled by the stepper driver broken or not connected		ON	ON	AUTO
EE	Unit parameter flash error		OFF	OFF	AUTO
EF	Operating parameter EEPROM error		OFF	OFF	AUTO
HA	HACCP alarm type 'HA'	HACCP	OFF	OFF	MAN
HF	HACCP alarm type 'HF'	HACCP	OFF	OFF	MAN
ccb	Start continuous cycle call	-	-	-	-
ccE	End continuous cycle call	-	-	-	-
dFb	Start defrost call	-	-	-	-
dFE	End defrost call	-	-	-	-
On	Switch ON	-	-	-	-
OFF	Switch OFF	-	-	-	-
rES	Reset alarms with MAN reset Reset HACCP alarms Reset temperature monitoring	-	-	-	-
MA	Communication error with the Master (only on Slave)		-	-	AUTO
u1-u4	Communication error with Slave 1-4 (only on Master)		-	-	AUTO
n1-n4	Indicates alarm on unit 1-4 in the network.		ON	ON	AUTO
upL	Signals upload procedure in progress	-	-	-	-
up1-up4	Signals upload procedure with errors on the unit 1-4.		OFF	OFF	-
uS_	Slave unit not configured	-	OFF	OFF	AUTO
bLo	Blocked valve alarm		ON	OFF	MAN

Tab. 8.a

ENGLISH

8.2 Table of alarms and signals: functions enabled/disabled

The following table indicates the functions that are enabled and disabled in the various alarm situations.

Code	Description	Compressor	Defrost	Evap. fans	Continuous cycle	Communicated to Lan	Effect on the valve network solenoid
'rE'	Control probe fault	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'E1'	Room probe S1 fault	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'E2'	Defrost probe S2 fault	unvaried	unvaried	unvaried	unvaried	√	
'E3'	Probe S3 fault	unvaried	unvaried	unvaried	unvaried	√	
'E4'	Probe S4 fault	unvaried	unvaried	unvaried	unvaried	√	
'E5'	Probe S5 fault	unvaried	unvaried	unvaried	unvaried	√	
'E6'	Probe S6 fault	unvaried	unvaried	unvaried	unvaried	√	
'E7'	Probe S7 fault	unvaried	unvaried	unvaried	unvaried	√	
'E8'	Serial probe S8 not updated	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'E9'	Serial probe S9 not updated	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'E10'	Serial probe S10 not updated	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'E11'	Serial probe S11 not updated	Duty setting ('c4')	unvaried	unvaried	unvaried	√	
'___'	Probe not enabled	unvaried	unvaried	unvaried	unvaried	√	
'LO'	Low temperature alarm (ref. Outlet probe if "Double thermostat")	unvaried	unvaried	unvaried	unvaried	√	
'HI'	High temperature alarm (ref. Outlet probe if "Double thermostat")	unvaried	unvaried	unvaried	unvaried	√	
'LO2'	Low temperature alarm (ref. Intake probe if "Double thermostat")	unvaried	unvaried	unvaried	unvaried	√	
'HI2'	High temperature alarm (ref. Intake probe if "Double thermostat")	unvaried	unvaried	unvaried	unvaried	√	
'IA'	Immediate alarm from external contact	duty setting ('A6')	unvaried	unvaried	unvaried	√	
'dA'	Delayed alarm from external contact	duty setting ('A6') if 'A7'<>0	unvaried	unvaried	unvaried	√	
'dEF'	Defrost running	unvaried	unvaried	unvaried	unvaried	√	
'Ed1'	Defrost on evaporator 1 ended by timeout	unvaried	unvaried	unvaried	unvaried	√	
'Ed2'	Defrost on evaporator 2 ended by timeout	unvaried	unvaried	unvaried	unvaried	√	
'dor'	Door open for too long alarm	unvaried	unvaried	unvaried	unvaried	√	
'Etc'	Real time clock fault	unvaried	unvaried	unvaried	unvaried	√	
'LSH'	Low superheat alarm	Off	unvaried	unvaried	unvaried	√	√
'LSA'	Low suction temperature alarm	Off	unvaried	unvaried	unvaried	√	√
'mOP'	Maximum operating pressure alarm	Off	unvaried	unvaried	unvaried	√	√
'LOP'	Low suction temperature alarm	unvaried	unvaried	unvaried	unvaried	√	√
'bLo'	Blocked valve alarm	unvaried	unvaried	unvaried	unvaried	√	
'Edc'	Communication error with stepper driver	unvaried	unvaried	unvaried	unvaried	√	
'EFS'	Motor controlled by the stepper driver broken	unvaried	unvaried	unvaried	unvaried	√	
'EE'	Unit parameter flash error	off	not perf.	off	not perf.	√	
'EF'	Operating parameter EEPROM error	off	not perf.	off	not perf.	√	
'HA'	HACCP alarm type 'HA'	unvaried	unvaried	unvaried	unvaried	√	
'HF'	HACCP alarm type 'HF'	unvaried	unvaried	unvaried	unvaried	√	
'MA'	Communication error with the Master (only on Slave)	unvaried	unvaried	unvaried	unvaried		
'u1'-'u4'	Communication error with Slave 1-4	unvaried	unvaried	unvaried	unvaried		
'n1'-'n4'	Indicates alarm on unit 1-4 in the network	unvaried	unvaried	unvaried	unvaried		
'upl'	Signals upload procedure in progress	unvaried	unvaried	unvaried	unvaried		
'up1'-'up4'	Signals upload procedure with errors on unit 1-4	unvaried	unvaried	unvaried	unvaried		

Tab. 8.b

9. TABLE OF PARAMETERS

Key to the table:
Code: code of the parameter as shown on the display;
Parameter: name of the parameter and any possible values;
Min, max or Def: Minimum, maximum or default value;
Type: C (configuration), F (frequent) or N (supervisor/program key/commissioning);
UOM: unit of measure;
Note: space for notes showing the settings of the parameters.

	Code	Parameter	Page	UOM	Type	Def.	Min	Max	Note
Temperature probe management parameters (/Pro)									
/Pro	/2	Analogue probe measurement stability	41	-	C	4	1	15	
	/4	Virtual probe composition0: outlet probe Sm; 100: intake probe Sr	28	-	C	0	0	100	
	/5	Select °C or °F 0: display in °C	38	flag	C	0	0	1	
	/6	Disable decimal point 0: decimal point enabled	38	flag	C	0	0	1	
	/t	Enable display alarms on the secondary terminal 0: display on second. term. disabled	38	flag	C	0	0	1	
	/t1	Select display on the main terminal 0: not present; 1 to 11: S1 to S11; 12: Control probe (Sreg); 13: Virtual probe (Sv); 14: Set point;	22	-	C	12	0	14	
	/t2	Select display on the secondary terminal (See /t1)	38	-	C	0	0	14	
	/P1	Select type of probe, Group 1 (S1, S2, S3) 0: Standard NTC with Range –50T90 °C 1: Standard PTC Range –50T150 °C 2: Standard PT1000 Range –50T150 °C 3: NTC K243 Standard Range -50T90 °C	35	-	C	0	0	3	
	/P2	Select type of probe, Group 2 (S4, S5) (See /P1)	35	-	C	0	0	3	
	/P3	Select type of probe, Group 3 (S6) 0 to 3: (See /P1); 4: 0 to 5 V ratiometric probe	35	-	C	0	0	4	
	/P4	Select type of probe, Group 4 (S7) 0 to 3: (See /P1); 4: 0 to 5 V ratiometric probe; 5: 0 to 10 V input; 6: 4 to 20 mA input	35	-	C	0	0	6	
	/P5	Select type of probe, Group 5 serial probes (S8 to S11) 0: temperature probes	35	-	C	0	0	15	
	/FA	Assign outlet temperature probe (Sm) 0: Function disabled; 1 to 11: S1 to S11	21	-	C	1	0	11	
	/Fb	Assign defrost temperature probe (Sd) (See /Fa)	21	-	C	2	0	11	
	/Fc	Assign intake temperature probe (Sr) (See /Fa)	21	-	C	3	0	11	
	/Fd	Assign evaporator outlet temp. probe (Tsuct EEV) (See /Fa)	37	-	C	0	0	11	
	/Fe	Assign saturated evaporation temp. probe (T/Psat EEV) (See /Fa)	37	-	C	0	0	11	
	/FF	Assign defrost temperature probe 2 (Sd2) (See /Fa)	37	-	C	0	0	11	
	/FG	Assign auxiliary temperature probe 1 (Saux1) (See /Fa)	37	-	C	0	0	11	
	/FH	Assign auxiliary temperature probe 2 (Saux2) (See /Fa)	37	-	C	0	0	11	
	/c1	Probe 1 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c2	Probe 2 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c3	Probe 3 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c4	Probe 4 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c5	Probe 5 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c6	Probe 6 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/c7	Probe 7 calibration	38	°C, °F or barg	C	0.0	-20.0	20.0	
	/U6	Maximum value of sensor 6 (barg)	36	barg	C	9.3	/L6	100.0	
	/L6	Minimum value of sensor 6 (barg)	36	barg	C	-1.0	-100.0	/U6	
	/U7	Maximum value of sensor 7 (barg)	36	barg	C	9.3	/L7	100.0	
	/L7	Minimum value of sensor 7 (barg)	36	barg	C	-1.0	-100.0	/U7	

	Code	Parameter	Page	UOM	Type	Def.	Min	Max	Note
Temperature control parameters (CtL)									
CtL	St	Unit set point	27	°C/°F	F	50.0	r1	r2	
	St2	Intake probe set point with "Double thermostat"	42	°C/°F	F	50.0	r1	r2	
	rd	Temperature set point differential	27	°C/°F	C	2.0	0.1	20.0	
	rd2	Control differential with "Double thermostat" 0.0: function deactivated	42	°C/°F	C	0.0	0.0	20.0	
	r1	Minimum set point	41	°C/°F	C	-50.0	-50.0	r2	
	r2	Maximum set point	41	°C/°F	C	50.0	r1	50	
	r3	Enable end defrost signal by timeout 0: signals disabled	58	flag	C	0	0	1	
	r4	Automatic night-time set point variation	28	°C/°F	C	0.0	-50.0	50.0	
	r5	Select maximum and minimum temperature monitoring probe. 0: disabled; 1: control probe (Sreg); 2: virtual probe (Sv); 3: outlet probe (Sm); 4: defrost probe (Sd); 5: intake probe (Sr); 6: superheated gas probe; 7: saturated evaporation probe; 8: auxiliary defrost probe; 9: auxiliary probe; 10: auxiliary probe 2.	58	-	C	0	0	10	
	rt	Duration of current maximum and minimum temperature monitoring session.	58	hours	C	-	0	999	
	rH	Maximum temperature acquired in the session	58	°C/°F	C	-	-	-	
	rL	Minimum temperature acquired in the session	58	°C/°F	C	-	-	-	
	r6	Enable night-time control on intake probe (Sr) 0: control on virtual probe (Sv) at NIGHT 1: control on intake probe (Sr) at NIGHT	28	flag	C	0	0	1	
	ro	Control offset in the event of probe error	41	°C/°F	C	0.0	0.0	20.0	
	r7	Enable solenoid output on Master as LAN solenoid only 0: compressor output for local valve; 1: compressor output for network valve	26	flag	C	0	0	1	

	Code	Parameter	Page	UOM	Type	Def.	Min	Max	Note
Compressor management parameters (CMP)									
CMP	c0	Enable compressor and fan delay on power-up	52	min	C	0	0	240	
	c1	Minimum time between successive starts	52	min	C	0	0	15	
	c2	Minimum off time	52	min	C	0	0	15	
	c3	Minimum on time	52	min	C	0	0	15	
	c4	ON time for operation in duty setting (Toff = 15 minutes fixed) 0: compressor/valve always OFF; 100: compressor/valve always ON	43	min	C	0	0	100	
	cc	Duration of continuous cycle operation	43	hours	C	1	0	15	
	c6	Low temperature alarm bypass time after continuous cycle	43	min	C	60	0	240	
Defrost management parameters (dEF)									
dEF	d0	Select type of defrost 0: heater defrost by temperature; 2: heater defrost by time; 3: hot gas defrost by time; 1: hot gas defrost by temperature; 4: heater defrost by temperature and time	29	-	C	0	0	4	
	d2	Enable end defrost synchronised by Master 0: end defrost not synchronised; 1: end defrost synchronised	53	flag	C	1	0	1	
	dI	Maximum interval between consecutive defrosts	29	hours	C	8	0	240	
	dt1	End defrost temperature (read by Sd)	29	°C/°F	C	8.0	-50.0	50.0	
	dt2	End defrost temperature (read bySd2)	54	°C/°F	C	8.0	-50.0	50.0	
	dP1	Maximum defrost duration	30	min	C	45	1	240	
	dP2	Maximum defrost duration on second evaporator	54	min	C	45	1	240	
	d4	Enable defrost on start-up 0: defrost on start-up disabled	53	flag	C	0	0	1	
	d5	Defrost delay on start-up if enabled	53	min	C	0	0	240	
	d6	Select display on terminal during the defrost 0: temperature alternating with 'dEF' on both displays 1: both displays off 2 'dEF' fixed on both displays	38	-	C	1	0	2	
	dd	Dripping time after defrosting (fans off)	54	min	C	2	0	15	
	d7	Enable "Skip defrost" 0: "Skip defrost" disabled	55	flag	C	0	0	1	
	d8	High temperature alarm bypass time after defrost and door open	30	min	C	30	0	240	
	d9	Disable defrost priority over solenoid times 0: protection times respected	52	flag	C	1	0	1	
	d/1	Defrost probe	30	°C/°F	F	-	-	-	
	d/2	Second evaporator defrost probe	54	°C/°F	F	-	-	-	
	dC	Time base for defrost 0: 'dI' expressed in hours, 'dP1', 'dP2' and 'ddP' in minutes 1: 'dI' expressed in minutes ,'dP1', 'dP2' and 'ddP' in seconds	53	flag	C	0	0	1	
	d10	"Running time" defrost time 0: function disabled	55	min	C	0	0	240	
	d11	Temperature threshold for "running time" defrost	55	°C/°F	C	-30.0	-50.0	50.0	
	dS1	Compressor off time for "sequential stop" defrost 0: function disabled	56	min	C	0	0	45	
	dS2	Compressor on time for "sequential stop" defrost	56	min	C	120	0	240	
	ddt	Additional end defrost temperature delta for "power defrost" mode	56	°C/°F	C	0.0	-20.0	20.0	
	ddP	Additional maximum end defrost time delta for "power defrost" mode	56	min	C	0	0	60	
	dn	Nominal duration of the defrost for "skip defrost"	55	%	C	75	0	100	
Alarm management parameters (ALM)									
ALM	AA	Assign high and low temperature alarm probe 1: Control; 5: Intake; 7: Saturated evap.; 2: Virtual; 4: Defrost; 8: Auxiliary defrost; 3: Outlet; 6: Sup. gas; 9: Auxiliary ; 10: Auxiliary 2.	32	-	C	1	1	10	
	A0	Reset high and low temperature alarm differential	32	°C/°F	C	2.0	0.1	20.0	
	A1	Select alarm thresholds relating to the absolute set point 0:'AL','AH','AL2'and'AH2' are considered relative thresholds to the set point 1:'AL','AH','AL2'and'AH2' are considered absolute thresholds	33	flag	C	0	0	1	
	AL	Low temp. alarm threshold (outlet probe Sm in "Double thermostat")	33	°C/°F	C	4.0	-50.0	50.0	
	AH	High temperature alarm threshold (outlet probe Sm in "Double thermostat")	33	°C/°F	C	10.0	-50.0	50.0	
	AL2	Low temperature alarm threshold on intake probe Sr ("Double thermostat" only)	58	°C/°F	C	0.0	-50.0	50.0	
	AH2	High temperature alarm threshold on intake probe Sr ("Double thermostat" only)	58	°C/°F	C	0.0	-50.0	50.0	
	Ad	Delay time for high and low temperature alarms	33	min	C	120	0	240	
	A4	Configure function of digital input DI1 on S4 0: input not active 4: start defrost 1: immediate external alarm 5: door switch with 2: delayed external alarm/ comp. and fans OFF display only 6: remote on/off 3: enable defrost 7: curtain switch	22	-	C	0	0	7	
	A5	Configure function of digital input DI2 on S5 (see 'A4')	22	-	C	0	0	7	
	A6	Configure solenoid control during external alarm (immediate or delayed) 0: compressor/valve always OFF; 100: compressor/valve always ON	52	min	C	0	0	100	
	A7	Delay time for delayed external alarm	24	min	C	0	0	240	
	A8	Configure function of virtual digital input (see 'A4')	40	-	C	0	0	7	
	A9	Select digital input propagated from Master to Slave 0: digital inputs not propagated; 3: DI3 propagated; 1: DI1 propagated; 4: DI4 propagated; 2: DI2 propagated; 5: DI5 propagated.	40	-	C	0	0	5	
	A10	Configure function of digital input DI3 on S6 (see A4)	22	-	C	0	0	7	
	A11	Configure function of digital input DI4 on S7 (see A4)	22	-	C	0	0	7	
	A12	Configure function of digital input DI5 (see A4)	22	-	C	0	0	7	
	Ar	Enable send alarms from Slave to Master 1: alarm signals enabled	58	flag	C	1	0	1	

	Code	Parameter	Page	UOM.	Type	Def.	Min	Max	Note
Evaporator fan management parameters (FAn)									
FAn	F0	Configure fan management 0: fans always on; 1: fans controlled based on the temperature difference between the virtual probe Sv (or Sr in double thermostat) and evaporator temperature (Sd); 2: fans controlled based on the temperature difference of the evaporator (Sd).	30	-	C	0	0	2	
	F1	Fan temperature control threshold (only if F0=1 or 2)	31	°C/°F	C	-5.0	-50.0	50.0	
	F2	Enable stop fans with controller off 0: no; 1: yes	31	flag	C	1	0	1	
	F3	Stop fans during the defrost 0: fans on during defrost; 1: fans off during defrost	31	flag	C	1	0	1	
	Fd	Post-dripping time after defrost (fans off with controller on)	31	min	C	1	0	15	
	Frd	Fan temperature control differential (including variable speed)	31	°C/°F	C	2.0	0.1	20.0	
	F5	Fan cut-off temperature (hysteresis 1°C)	57	°C/°F	C	50.0	F1	50.0	
	F6	Maximum fan speed	57	%	C	80	F7	100	
	F7	Minimum fan speed	57	%	C	10	0	F6	
	F8	Fan start-up time 0: function disabled	57	s	C	0	0	240	
	F9	Select fan control with PWM1/2 output (with speed management by phase control) 0: duration; 1: impulse	57	flag	C	1	0	1	
Valve management parameters (Evd)									
EVd	P1	EEV – Main Select model of electronic valve 0: Valve not present; 1: PWM valve; 2: CAREL E2V valve.	45	-	C	0	0	2	
	P3	EEV – PID Superheat set point	45	K	C	10.0	0.0	25.0	
	P4	EEV – PID Proportional gain	47	-	C	15.0	0.0	100.0	
	P5	EEV – PID Integration time 0: function disabled	47	s	C	150	0	900	
	P6	EEV – PID Derivative time 0.0 function disabled	48	s	C	5.0	0.0	100.0	
	P7	EEV – LSH Low superheat threshold	48	K	C	7.0	-10.0	P3	
	P8	EEV – LSH Low superheat integration time 0.0: function disabled	48	s	C	15	0	240	
	P9	EEV – LSH Low superheat alarm delay 0: alarm disabled	48	s	C	600	0	999	
	P10	EEV - Main Enable close solenoid valve for low superheat LSH and/or low suction temperature LSA	49	flag	C	1	0	1	
	P11	EEV – LSA Low suction temperature threshold	50	°C/°F	C	-45.0	-50.0	50.0	
	P12	EEV – LSA Low suction temperature alarm delay 0: alarm disabled	50	s	C	600	0	999	
	P13	EEV – LSA Low suction temperature alarm differential (°C) 0.0: always automatic reset	50	°C/°F	C	10.0	0.0	60.0	
	P15	EEV – Main Support saturated temp. in the event of pressure probe error	47	°C/°F	C	-8.0	-50.0	50.0	
	PH	EEV – Main Type of refrigerant 1: R22 3: R404a 5: R410a 7: R290 9: R600a 11: R744 13 R1270 2: R134a 4: R407c 6: R507a 8: R600 10: R717 12: R508a 14 R417a	45	-	C	3	1	14	
	OSH	EEV – ADV Superheat offset for modulating thermostat 0.0: function disabled	46	K	C	0.0	0.0	60.0	
	Phr	EEV – ADV Enable fast update of the valve parameters to supervisor 0: fast update disabled	46	flag	C	0	0	1	
	PM1	EEV – MOP MOP threshold (saturated evaporation temperature)	49	°C/°F	C	50.0	-50.0	50.0	
	PM2	EEV – MOP MOP integration time	49	s	C	10	0	240	
	PM3	EEV – MOP MOP alarm delay 0: function disabled	49	s	C	0	0	999	
	PM4	EEV – MOP MOP function delay when starting control	49	s	C	2	0	240	
	PM5	EEV – MOP Enable close local solenoid valve for MOP alarm	49	flag	C	0	0	1	
	PL1	EEV – LOP LOP threshold (saturated evaporation temperature)	50	°C/°F	C	-50.0	-50.0	50.0	
	PL2	EEV – LOP LOP integration time	50	s	C	0	0	240	
	PL3	EEV – LOP LOP alarm delay 0: alarm disabled	50	s	C	0	0	240	
	Po1	Superheat	51	K	F	-	-	-	
	Po2	Valve opening percentage	51	%	F	-	-	-	
	Po3	Superheated gas temperature	51	°C/°F	F	-	-	-	
	Po4	Saturated evaporation temperature	51	°C/°F	F	-	-	-	
	Po5	Saturated evaporation temperature calibration	38	°C/°F	C	0.0	-20.0	20.0	
	Po6	EEV – ADV PWM expansion valve Ton + Toff	51	s	C	6	1	20	
	cP1	EEV – ADV Initial valve position at start control	46	%	C	30	0	100	
	Pdd	EEV – ADV Initial valve position maintenance time after defrost	46	min	C	10	0	30	
	Psb	EEV – ADV Valve standby position	46	steps	C	7	0	400	
General configuration parameters (CnF)									
CNF AUX	In	Select type of unit, MASTER or SLAVE 1: Master	25	-	C	1	0	1	
	Sn	Number of slaves in the local network	25	-	C	0	0	4	
	H0	Serial address	25	-	C	199	0	199	
	H1	Configure function of AUX1 output 0: No function ass. with the output; 1: Alarm output de-energised; 2: Alarm output normally energised; 3: Auxiliary output; 4: Auxiliary output salved to MASTER on slaves; 5: Light output; 6: Light slaved to MAST. on Slaves; 7: Auxiliary evaporator def. output; 8: Evap. fan output	24	-	C	8	0	8	
	H2	Disable keypad and remote control functions 1: keypad and remote control enabled	39	-	C	1	0	5	
	H4	Remote control enabling code 00: programming from the remote control without code	39	flag	C	0	0	1	
	H5	Disable terminal buzzer (if present) 0: buzzer enabled	24	-	C	2	0	8	
	H6	Configure function of AUX2 output (see 'H1')	39	-	C	0	0	15	
	H7	Configure terminal keypad lock	24	-	C	5	0	8	
	H8	Select output switched with time bands (Light and Aux) 0: NIGHT/DAY time band linked to LIGHT. 1: NIGHT/DAY time band linked to AUX.	27	flag	C	0	0	1	
	H9	Select function associated with terminal AUX button (Light or AUX) 0: AUX button associated with light output function 1: AUX button associated with AUX auxiliary output function.	25	-	C	0	0	1	

	Code	Parameter	Page	UOM	Type	Def.	Min	Max	Note
Alarm log parameters (HSt)									
	Htc	Clock option 0: clock absente	26	-	C	0	0	1	
CNF	Hhu	Hot wire PWM 1 and 2 activation time (on period of 240 seconds) 0: hot wire function disabled	26	s	C	240	0	240	
	HS0...9	Alarm event 0 to 9	58	-	C	-	-	-	
AUX	___	Alarm event 0 to 9 - Code	58	-	*	-	-	-	
	h__	Alarm event 0 to 9- Hour	58	Hours	*	-	0	23	
	n__	Alarm event 0 to 9- Minute	58	Min	*	-	0	59	
	___	Alarm event 0 to 9- Duration	58	Min	*	-	0	999	
HACCP alarm management parameters (HcP)									
	HAn	Number of HA alarms	60	-	C	0	0	15	
	HA...HA2	Number of type HA to HA2 HACCP events activated	59	-	C	-	-	-	
	HA	Details of HACCP alarm HA1 to 3	59	-	C	-	-	-	
	y__	HACCP alarm HA to HA2 - Year	59	Years	*	-	0	99	
	M__	HACCP alarm HA to HA2 - Month	59	Months	*	-	1	12	
	d__	HACCP alarm HA to HA2 - Day	59	Days	*	-	1	31	
	h__	HACCP alarm HA to HA2 - Hour	59	Hours	*	-	0	23	
	n__	HACCP alarm HA to HA2 - Minute	59	Min	*	-	0	59	
Hcp	___	HACCP alarm HA to HA2 - Duration	59	Min	*	-	0	240	
	HFn	Number of HF alarms	60	-	C	0	0	15	
HACCP	HF1...3	Number of type HF1 to 3 HACCP events activated	60	-	C	-	-	-	
	HF	Details of HACCP alarm HF 1	60	-	C	-	-	-	
	y__	HACCP alarm HF to HF2 - Year	60	Years	*	-	0	99	
	M__	HACCP alarm HF to HF2 - Month	60	Months	*	-	1	12	
	d__	HACCP alarm HF to HF2 - Day	60	Days	*	-	1	31	
	h__	HACCP alarm HF to HF2 - Hour	60	Hours	*	-	0	23	
	n__	HACCP alarm HF to HF2 - Minute	60	Min	*	-	0	59	
	___	HACCP alarm HF to HF2 - Duration	60	Min	*	-	0	240	
	Htd	HACCP alarm delay 0: monitoring disabled	59	Min	C	0	0	240	
RTC management (Real Time Clock) and timed defrost (rtc) parameters									
	td1…8	Details of defrost event 1 to 8	30	-	C	-	-	-	
	d__	Defrost 1 to 8 - Day 0: event disabled; 9: Monday to Saturday; 1 to 7: Monday to Sunday; 10: Saturday & Sunday; 8: Monday to Friday; 11: every day.	30	Days	*	0	0	11	
	h__	Defrost 1 to 8 - Hour	30	Hours	*	0	0	23	
	n__	Defrost 1 to 8 - Minute	30	Min	*	0	0	59	
	P__	Defrost 1 - Enable Power defrost (type of defrost) 0: normal; 1: power defrost	30	flag	*	0	0	1	
	tS1…8	Start day details, time band 1 to 8	26	-	C	-	-	-	
rtc	d__	Start day details, time band 1 to 8 - Day	26	Days	*	0	0	11	
	h__	Start day details, time band 1 to 8 - Hour	26	Hours	*	0	0	23	
	n__	Start day details, time band 1 to 8 - Minute	26	Min	*	0	0	59	
	tE1…8	End day details, time band 1 to 8	26	-	C	-	-	-	
	d__	End day details, time band 1 to 8 - Day	26	Days	*	0	0	11	
	h__	End day details, time band 1 to 8 - Hour	26	Hours	*	0	0	23	
	n__	End day details, time band 1 to 8 - Minute	26	Min	*	0	0	59	
	tc	RTC date/time setting	26	-	C	-	-	-	
	y__	Year	26	Years	0	00	00	99	
	M__	Month	26	Months	*	1	1	12	
	d__	Day of the month	26	Days	*	1	1	31	
	u__	Day of the week	26	Days	*	6	1	7	
	h__	Hour	26	Hours	*	0	0	23	
	n__	Minute	26	Min	*	0	0	59	
Supervisor system parameters									
	PF	EEV - ADV Valve opening steps	51	-	N	-	0	480	
	PMP	EEV - ADV Enable manual positioning of expansion valve 0: manual positioning disabled	51	-	N	-	0	1	
	PMu	EEV - ADV Manual valve position	51	-	N	-	0	600	
Parameters from programming key and/or commissioning tool									
	Hdn	Number of sets of default parameters available	40	-	N	0	0	2	
	PS	Password to display configuration parameters	35	-	N	22	0	200	
	PSS	Password to enter alarm log	35	-	N		PS + 22		
	PSU	Password to enter parameter upload	35	-	N		PS + 44		

Tab. 9.a

10. TECHNICAL SPECIFICATIONS

Power supply	**Model**	**Voltage**	**Power**
	MXxxxxxExx	230 V~ , 50/60 Hz	11.5 VA, 50 mA~ max
	MXxxxxxAxx	115 V~ , 50/60 Hz	11.5 VA, 100 mA~ max
Insulation guaranteed by the supply	MXxxxxx(E,A)xx	insulation from very low voltage parts	reinforced 6mm in air, 8mm on surface 3750 V insulation
		insulation from relay outputs	main 3mm in air, 4mm on surface 1250 V insulation
Inputs	S1, S2 and S3	NTC (MXxxxx0xxx) or NTC, PTC, PT1000 and NTC L243 (MXxxxx(1,2,3,4,5,6,7,8)xxx)	
	S4, S5 DI1, DI2	NTC (MXxxxx0xxx) or NTC, PTC, PT1000 and NTC L243 (MXxxxx(1,2,3,4,5,6,7,8)xxx) voltage-free contact, contact resistance < 10 ohm, closing current 6 mA	
	S6 DI3	NTC (MXxxxx0xxx) or NTC, PTC, PT1000 and NTC L243 (MXxxxx(1,2,3,4,5,6,7,8)xxx) 0 to 5 V ratiometric (MXxxxxxxxx) voltage-free contact, contact resistance < 10 ohm, closing current 6 mA	
	S7 DI4	NTC (MXxxxx0xxx) or NTC, PTC, PT1000 and NTC L243 (MXxxxx(1,2,3,4,5,6,7,8)xxx) 0 to 5V ratiometric, 4 to 20 mA , 0 to 10 V (MXxxxxxxxx) voltage-free contact, contact resistance < 10 ohm, closing current 6 mA	
	DI5	voltage-free contact, contact resistance < 10 ohm, closing current 6 mA	
	Maximum distance of probes and digital inputs less than 10 m. Note: in the installation, keep the power and load connections separate from the probe, digital inputs, repeater display and supervisor cables.		
Probe type	Std. CAREL NTC	10 kΩ at 25°C, range from –50 °C to +90 °C	
		measurement error	1 °C in the range from –50 °C to +50 °C; 3 °C in the range from +50 °C to +90 °C
	Std. CAREL PTC (specific model)	985 Ω at 25°C, range from -50°C to 150 °C	
		measurement error	2 °C in the range from –50 °C to +50 °C; 4 °C in the range from +50 °C to +150 °C
	Pt 1000	1000Ω at 0 °C, range from –50 °C to +90 °C	
		measurement error	3 °C in the range from –50 °C to 0 °C; 5 °C in the range from 0 °C to +90 °C
	NTC L243	2000 Ω at 0 °C, range from -50°C to 90 °C	
		measurement error	2 °C in the range from –50 °C to +25 °C
	0 to 5 V ratiometric	resolution 0.1 % fs	
		measurement error	2 % fs maximum; 1 % typical
	4...20 mA	resolution 0.5 % fs	
		measurement error	8 % fs maximum; 7 % typical
	0...10 V	resolution 0.1 % fs	
		measurement error	9 % fs maximum; 8 % typical

Relay outputs

depending on the model

	EN60730-1			UL 873	
model	**relay**	**250V~**	**operating cycles**	**250V~**	**operating cycles**
MXxxxxxx(A,G,M)x	R1, R5 R4	8 (4) A on N.O. 6 (4) A on N.C. 2 (2) A on N.O. & N.C.	100000	8A res 2FLA 12LRA C300	30000
	R2, R3	12 (2) A on N.O. & N.C.	100000	12A res 5FLA 30LRA C300	30000
	R2	10 (10) A	100000	12A res 12FLA 72LRA	30000
	EN60730-1			**UL 873**	
model	**relay**	**250V~**	**operating cycles**	**250V~**	**operating cycles**
MXxxxxxx(B,N)x	R1, R5 R4	8 (4) A on N.O. 6 (4) A on N.C .2 (2) A on N.O. & N.C.	100000	8A res 2FLA 12LRA C300	30000
	R2, R3	10 (2) A on N.O. & N.C.	100000	10A res 5FLA 30LRA C300	30000
	R2	10 (10) A	100000	10A res 10FLA 72LRA	30000
	EN60730-1			**UL 873**	
model	**relay**	**250V~**	**operating cycles**	**250V~**	**operating cycles**
MXxxxxxx(C,I,O)x	R1, R5 R4	6 (4) A on N.O. 6 (4) A on N.C. 2 (2) A on N.O. & N.C.	100000	6 A res 2 FLA 12 LRA C 300	30000
	R2, R3	8 (2) A on N.O. & N.C.	100000	8 A res 5 FLA 30 LRA C 300	30000
	R2	8 (10) A	100000	8 A res 8 FLA 72 LRA	30000
	insulation from very low voltage parts		reinforced 6mm in air, 8mm on surface 3750V insulation		
	insulation between the independent relay outputs		main 3mm in air, 4mm on surface 1250 V insulation		

PWM analogue outputs 1, 2	**model**	**Output voltage, maximum current available (not isolated from the board earth)**
	MXxxx(2, 3)xxxx	12 Vdc, 20 mA max for each PWM

Connections	**Type of connection**				**Cross-section**	**Maximum current**
	model	**relay**	**power supply**	**probes**		
	MXxxxxxx(A,G,M)x	screw 180°	screw 180°	screw 180°	for cables from 0.5 to 2.5 mm²	12 A
	MXxxxxxx(B,N)x	plug-in 90°	plug-in 90°	plug-in 90°		
	MXxxxxxx(C,I,O)x	plug-in 180°	plug-in 180°	plug-in 180°		
	The correct sizing of the power cables and the connections between the instrument and the loads is the installer's responsibility.					

Case	none	MXxxxxxx(A,B,C)x
	support base	MXxxxxxx(G,I)x
	support base and cover	MXxxxxxx(M,N,O)x
Assembly	on plastic spacers	MXxxxxxx(A,B,C)x
	on DIN rail	MXxxxxxx(G,I,M,N,O)x
No option	MXxxxx0x(0,1,2)x	
Clock with backup battery	MXxx(M,S)xxxxx	
RS485 interface	MXxx(M,S)xxxxx	
Parameter and firmware customisation	MXccxxxxn; cc customer identification; n progressive customisation	

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Clock	error at 25°C	± 10 ppm (±5.3min/year)
	error in the temp. range –10T60 °C	- 50 ppm (-27min/year)
	ageing	< ±5 ppm (±2.7min/year)
	Discharge time	typically 6 months (8 months maximum)
	Recharge time	typically 5 hours (<8 hours maximum)
Operating temperature	MXxxxxxx(A,B,C,G,I)x	-10T60 °C
	MXxxxxxx(M,N,O)x	-10T50 °C

Index of protection	IP00
Operating humidity	<90% RH non-condensing
Storage temperature	-20T70 °C
Storage humidity	<90% RH non-condensing
Environmental pollution	2 (normal)
PTI of the insulating materials	printed circuits 250, plastic and insulating materials 175
Period of stress across the insulating parts	Long
Category of resistance to fire	category D and category B (UL 94-V0)
Class of protection against voltage surges	category II
Type of action and disconnection	1C relay contacts (microswitching)
Construction of the control device	integrated electronic control device
Classification according to protection against electric shock	Class 2 when suitably integrated
Device designed to he hand-held or integrated into equipment designed to be hand-held	no
Software class and structure	Class A
Cleaning the front panel of the instrument	only use neutral detergents and water
Main and secondary display	External
Maximum distance between controller and display	10 m, shielded cable (power supply, rx-tx, gnd)
LAN connection	50 m total, shielded cable (rx-tx, gnd)
Programming key	Available in all models

Tab. 10.a

Dimensions (mm)

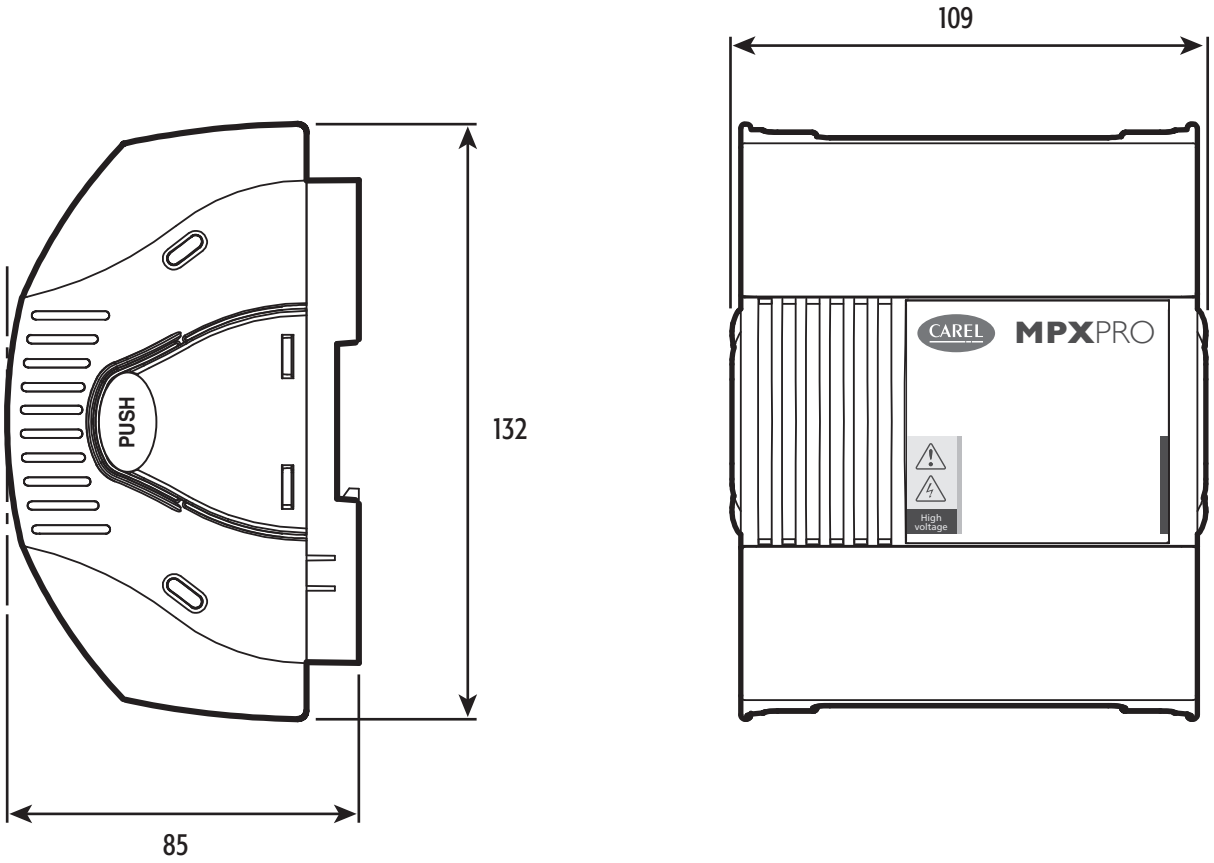

Fig. 10.a

CAREL

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